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Military Supply of Large Units

Some Principles of Mobilization, Logistics, and Control

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AT the opening session of the Command Post Exercise held at Fort Sam Houston, Texas, September 18, 1936, I had the honor of addressing the officers engaged in that exercise. Maj. Gen. Frank Parker, then Commander of the Third Army and of the Eighth Corps Area, presided. The Editor of ARMY ORDNANCE has expressed an interest in my address and I am, of course, glad to be of service to the readers of this publication. My informal remarks are recorded below substantially as they were delivered. They deal with an extremely important phase of our national defense, and if their publication here will stimulate thought on the problem of military supply of large units, then I shall feel that they will have served an additional purpose. Here is what I told the assembled officers:

I am sure you all realize how fortunate we are in having General Parker as our Commander in this exercise. Thus we can profit by his experience as a battle leader. Certainly General Parker must stand in history as one of the foremost battle leaders of the American forces in the World War.

I am to have the privilege of speaking to you on the general subject of logistics and the supply of large units. I shall approach the subject from the point of view of the high command and not from the point of view of the services. In a well-organized army the tail does not wag the dog, notwithstanding some very high opinions to the contrary. I shall therefore speak about strategic supply rather than tactical supply. A question becomes one of strategic supply when it is of such importance that it is decided by a superior commander or general staff. Tactical supply is the actual distribution of supplies which have been properly placed strategically.

For the benefit of the younger officers, I wish to point out very briefly the great change which has taken place in our Army since the General Staff was recognized. When I first entered the War Department as a captain of the General Staff, it was a queer War Department indeed, controlled generally by three men; first, the Quartermaster General, who went to Congress for practically all the money and who very largely controlled the spending of that money. Then there was the Judge Advocate General, who interpreted the law—and his decisions were like the laws of the Medes and the Persians, unchangeable, and unchallengeable. Then there was the Adjutant General who controlled personnel matters and channels of communication within the Army. What is the situation today? The General Staff controls the War Department budget completely. It decides what funds shall be asked for and how those funds shall be spent. The General Staff listens with respect, with interest, and sometimes with amusement to the opinions of the lawyers, but it decides for itself the course to pursue or to recommend. Picture to yourself the tragedy to the Army had Secretary Baker accepted the opinion of General Crowder, then Judge Advocate General of the Army, as to the powers and limitations of the General Staff. The fact is, he disapproved General Crowder's opinion entirely. Mr. Baker later contributed much to the winning of the war, but probably his greatest contribution was his decision sustaining the War Department General Staff for all time.

May I be permitted to say right here that never in my wildest dreams did I ever wish to have anything to do with supply. I had gone overseas as a lieutenant colonel, 5th Field Artillery, 1st Division, most happy in that assignment. My promotion came to me in the 1st Division, but after we returned from our first tour at the front, I was ordered to the General Staff at Army Headquarters and had something to do with the building of the A. E. F. Later I relieved Gen. William D. Connor and operated the great system of supply which came under his section, not only throughout the war, but during most of our withdrawal from France. I have used the word "operate" advisedly. Does a General Staff officer operate? He certainly does, but he uses existing organizations to accomplish what he has in mind. For a time after the war, we had a very efficient Adjutant General who attempted to prove that the General Staff does not and properly should not operate, but he lost his case. He had the idea that a General Staff officer could not accomplish anything until he found an Adjutant General or one of the many Assistants Adjutant General, to whom he would state his plans, and the Adjutant General would put them into effect. A General Staff officer, speaking in the name of his chief, tells subordinates what to do. Often operating at long distances from his chief, he is called upon to estimate a situation, come to a decision, and give orders directly. He can meet such a situation in an emergency because he knows intimately the mind and wishes of his commander, of whom he is a part.

NOW, I want you to walk with me from our corps areas where our troops are mobilizing, to the front line, permitting me to point out a very few of the important general principles of supply which should be insisted upon. Before we start, let us bear in mind that our success in the next great emergency will be in direct proportion to the extent to which we decentralize production to industry, and command to military men. Remember too, that our supply system must be organized so

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as to meet the needs of the fighting troops, for troops sent to combat must be relieved of all supply worries as far as possible. Finally, in the next emergency I hope we will have a big, able, square-jawed commander in chief who will support his subordinates as did John J. Pershing during the war.

Supplies needed for the initial mobilization must be either in the hands of troops or within the corps area under the jurisdiction of corps area commanders. This means a proper corps area depot centrally located. The system is greatly facilitated by good National Guard armories with proper storage facilities, which are so few and far between in the South at the present time. No requisitions should be required on M-Day. The flow of supplies should be automatic in conformity with previously authorized requirements. While troops in the initial mobilization are not concentrated within their corps areas, the plan should require such concentration as will facilitate transportation and the providing of proper loads for type trains. All this can be accomplished easily by the use of trucks now available within the corps areas.

The War Department should decentralize the larger portion of this problem keeping only a regulating control in Washington. In fact, the War Department must constantly ask itself, "How many of these problems can be anticipated now, solved and decentralized?" Remember, there is no danger in decentralization so long as you retain control over the officer to whom you have assigned the task.

OUR initial mobilization having been ordered, what great supply activity has been put in motion concurrently, preparing to meet the needs of our national Army and the nation at war? In this connection, I want to say a word right here about the duties of the Assistant Secretary of War and about the Army Industrial College. The work of the Assistant Secretary of War in procurement and the activities of the Army Industrial College have not been well understood. For a long time they were not properly appreciated by the General Staff itself. As a matter of fact, most of the great plans of the General Staff would be impossible of execution if the procurement plans of the Assistant Secretary of War failed.

It is the General Staff that figures out all requirement needs for each and every emergency. These needs are carefully coordinated with the needs of the Navy. It is the Assistant Secretary of War, using the procurement sections of the various services, who goes shopping with this great list to American industry, allocating the items where they can be obtained most readily. At the Army Industrial College, officers of the Army, Navy, and Marine Corps work side by side, studying these nation-wide problems and fitting themselves for this important duty. In the study of each item the investigation goes to the very foundation, that is, the raw materials that are involved.

Supplies completed, ready for issue, come immediately under military control and they are marshaled and dispatched as are troops.

The question of the supply of personnel is not properly included in my subject, but I mention it, for I find no plan to localize national Army divisions. This was generally accomplished in the World War and it had an all-important bearing upon morale. It should be accomplished in our present mobilization plans.

In every mobilization we have had, there has always been, at the outset, a shortage of personal clothing and such items as blankets. The Quartermaster General may say he has them somewhere in stock, but we want proper underclothes, socks, and shoes on the lad himself before we raise the anxiety of the mother. I propose for the next emergency that every draftee coming from his home community bring with him—according to the season—two pairs of shoes, the necessary underclothes, socks, two blankets, and denim suit—all purchased locally under proper supervision. This will relieve us of many worries during the critical period of mobilization. Supply officers may tell you that they can furnish this equipment. They may be able to do so, but we had many difficulties during the early mobilization of the CCC, notwithstanding the fact that the items we were calling for were commercial items, not military items at all. Issues were often far behind requirements.

Right here let me refer to another important question. It is this. For what kind of a war are we preparing? There has been a lot of loose talk about Uncle Sam remaining entirely on the defensive. What does that mean? Does it mean that we are going to wait until the enemy actually comes and lands on our shores? That we are going to furnish the battlefields? That the cities destroyed are to be ours? Certainly the South, which has had some experience along this line, will not willingly submit to it again. No, we will do just as we always have done in pursuing all honorable means to avoid war and to remain on friendly terms with all our neighbors. But if we fail in such a diplomatic effort and the enemy lays definite plans to attack, certainly we will lead out with our right and follow it up strategically with a powerful left. In my time in the Army we have experienced overseas operations in the Caribbean, in the Far East, and in Europe. So we can today figure on the most difficult case of an overseas campaign.

How history repeats itself! In 1898, uncontrolled and uncoordinated shipments were made to the seaboard at Tampa. The main lines were congested for miles and the troops were not properly supplied. In the World War we repeated the error on a grander scale and there was great congestion behind most Atlantic ports. Today a fine plan has been worked out, including the establishment of holding and reassignment points for regulating stations many miles behind seaboard. No shipments will be made to seaboard until a release has been secured. I hope we will be able to compel officials to obey those instructions. We found it very difficult to enforce such a plan in the theater of operations in France.

I HAVE indicated how the War Department General Staff figures all requirements. Those requirements go into industry. The General Staff in the theater of operations figures requirements for the troops employed, together with priorities and time-tables of arrival. Supplies of all kinds arrive at base ports and are put into base depots for sorting, where necessary, and for temporary storage until storage becomes available elsewhere. In the World War, our depots in the S.O.S. were designated "base," "intermediate," and "advance" depots, depending upon their location. It would be far better to name them according to their functions. There must always be base depots for an overseas expedition. The War College has recommended that the names, "intermediate" and "advanced" depots be changed to "distribution" depots. The suggestion is a good one. All distribution depots should carry balanced stocks and be prepared to issue to troops directly,

by train or by truck. These depots generally contain everything except railway equipment, truck equipment, heavy engineer equipment, and ammunition. Stores must be assembled in balanced lots so that if one warehouse goes, only a small percentage of all is lost. To meet modern conditions, warehouses must be widely dispersed for protection against air attacks and the fire resulting therefrom.

THE location of a large depot is no small matter. It is a responsibility of G-4 at the superior General Staff. It must be on a main line leading to the front. It must be so placed as to add to the flexibility of the whole supply system. It must not be situated so as to be involved in a small reverse. A corps improperly placed may be moved, if it has not already become seriously involved in the fight, but a depot incorrectly placed cannot be moved until after months of delay and enormous expense. The strategy of G-4 must be sound.

And now a word about transportation. In peace, the Quartermaster Corps handles all transportation to avoid having a lot of separate services involved in the question. In war, no agency which is itself a shipper should be put in charge of transportation, for transportation must be equally available to all. As a general rule I agree whole-heartedly with the principles taught today at the Army War College, but recently I have been shown a study which places all transportation under one great service. It will never do for war purposes. Railway transportation is a distinct service and nothing should be added to it except light railways. Trucks are needed as an integral part of many military organizations. A railway needs many trucks for local service, but truck trains for the movement of troops and supplies constitute a separate service, and a motor transport corps is needed as a separate entity in war. The coördination necessary between railway transportation corps and the motor transport corps will be accomplished by G-4. During the last year of the war we moved more troops in the zone of the armies by truck than by train. General Atterbury, who knew how to run the Pennsylvania Railroad in peace, knew little of what was required of the railway service in the zone of the armies, now called the combat zone, and he knew absolutely nothing about motor transportation.

AS we leave the S.O.S. for the communication zone, as it is now called, we pass through the regulating stations—the points of articulation between the communication zone and the combat zone. If our organization is functioning properly, these regulating officers should be the first officials in the scheme of supply who know just where the combat troops are. Each such regulating officer receives his daily calls from the troops charged to him, and he makes proper calls on certain designated depots which are supporting his station. The regulating officer prescribes just how and when these stocks are to be loaded and sent forward. To facilitate making up the daily trains for each division and attached troops, the regulating officer generally dispatches these trains to railhead during the night so that distribution from railhead can take place at daylight. Regulating stations require antiaircraft defense. Limited stocks are generally kept at regulating stations to balance requirements and to meet small calls. Stocks are also kept at army depots and dumps, the amounts depending on the mobility of the campaign. It is prescribed that the regulating officer be a staff officer of the army commander. During the war I found it necessary to make him a commanding officer also, with all the powers that went with command. This was done so as to better protect him from the many annoyances that came throughout the day and throughout the night.

A most striking example of the mobility and efficiency attained by the operation of a regulating station is that presented by the 1st and 2nd Divisions during their movements immediately preceding and during their memorable counter-attack south of Soissons in July, 1918. These two units were withdrawn from the lines and moved rapidly by march and motor truck so that they each had *seven different railheads in eight days;* yet the supply train from the regulating station at Le Bourget (Seine) arrived each day at the required spot. So complete was the secrecy of this movement that only the Supreme Command knew what the final disposition of these troops was to be, and to the fact that it was so entirely unexpected was the success of this attack largely due.

LET me say a word now in reference to supply in battle. With small commands, we are accustomed to see the commanding officer go into a huddle with his staff and give his orders. This is not so at the high-command headquarters. If you have ever taken part in these conferences you will remember that only commanders appeared with certain superior general staff officers. The whole system of general staff control is ideal in that commanders can handle their problems by dealing with four general staff officers under whom all matters are coördinated. Thus, plans do not have to be divulged except to a limited few. Often these conferences take place before the troops have arrived and plans must be kept secret until the last, when tactical orders go out. The chiefs of the services which are involved are given definite tasks, and they meet their responsibilities fully if they accomplish those tasks; it is not necessary for them to know at the outset the exact nature of the tactical operations which are involved.

Our attack at Saint-Mihiel was a good example of this staff work. Days before the arrival of the troops, the services were given definite tasks. The Medical Department was informed that so many hospital beds were to be available in a certain area. The Ordnance Department was directed to lay down certain ammunition supplies at certain dumps, and as a matter of fact this took something over a hundred French trains. The Quartermaster Corps was given its tasks. Days afterwards, all the troops arrived and at the last the tactical orders went out. An interesting incident happened in reference to this attack. On August 29, 1918, I received instructions to report to General Pershing at his field headquarters, Ligny-en-Barrois. I arrived late in the afternoon and found General Pershing in conference with Marshal Foch. There were only two other persons present at that conference. They were Colonel Boyd and Colonel Bowditch, the General's aides. The Marshal stated that he felt that the enemy was in great strength in the Saint-Mihiel salient and would be prepared to meet us in force. As you may remember, the French had never had any success in that area. The Marshal asked how long it would take us to make arrangements so that we could attack on the other side (west) of the Meuse River. General Pershing put the question to me and as I now recall, I stated that it would take at least ten days or two weeks. Whereupon, the Marshal said for us to go ahead with our attack as planned.

As a rule, the General Staff is only concerned with the

larger problems. There are exceptions, however, when a detail may become a matter of the greatest importance; for example, the Quartermaster Department furnishes shoes for the Army, but the General Staff prescribes the kind of shoes needed for marching troops. Likewise, they prescribe the types of every article of equipment required. Similarly, the Quartermaster Department furnishes bread, and the Quartermaster will tell you that this is his problem, but the General Staff will tell him the type of bread it wants in campaign, and it did so during the war. As a matter of fact, he was told that if he did not furnish a certain type of field bread on and after a certain date, we would draw our bread from the French, furnishing them flour in kind. He complied, and later on he was proud of the American field bread which he baked.

THERE is a lot of "bull" in war and the World War was no exception. I am speaking to you frankly, because we want the facts and the lessons. There was a board set up toward the end of the World War, called The Military Board of Allied Supplies. Records will show you that they had no authority, in themselves, to handle a single question. They could meet at luncheon and recommend many things, or just sit and eat. The responsible group that handled those questions in the World War was composed of the Chiefs of the Fourth Section of the General Staff of the Allies, who met from time to time. As the organization of the armies was not identical, these officers were called by various titles. Most of the questions involved, however, were solved at the moment either directly or over the telephone, and in these telephone conversations we often exchanged tons of supplies and equipment. As one example, the Chief of the Fourth Section of the French Army called us up one morning and said they were out of flour at their great bakeries at Troyes. That same day a solid trainload of American flour was ordered to Troyes and the bakeries went on. The whole transaction took about five minutes.

Have any of these principles been challenged? No one has ever claimed that we failed during the war, but one officer, a great friend of mine, General Hagood, always claimed that he had another way and could have done it better, and he wrote a book on the subject after the war. However, General Hagood forgot that shortly after the Armistice, General Pershing had a board investigate these principles to determine what we should do in the event of another similar emergency. General Hagood, being the principal objector, was the principal witness, and after talking at length, he finally closed his testimony with this remark: "After all," he said, "if we were going to fight this war over again, confronted by the same conditions on the same terrain, we would want the organization just as you men had it." However, a much more serious comment has been made in General Harbord's recent book, written some eighteen years after the war. We hear much talk of changing the Constitution of the United States. Personally I don't believe in changing it, but if we do, I hope we will put in a provision allowing warriors one year after the emergency in which to write their memoirs, but thereafter requiring them to hold their peace. General Harbord has taken up the Hagood case anew, but he stands alone in his recommendation. He does not agree with the teaching of the War College at the present time. He does not agree with our present field service regulations. Gen. William D. Connor made a complete review of the case before the Army War College recently, sending a copy of his review to General Pershing, Gen. Fox Conner, General DeWitt and myself. General Pershing wrote back as follows: "I am in entire agreement with your views as they are based on my own decisions taken at the time. I think they are absolutely correct and am prepared to back them up if necessary. If and when you give another lecture, you should have no hesitancy in stating what you think and why, with apologies to no one."

Gen. Fox Conner, writing about the same principles, said: "It is hardly necessary for me to say that I agree with you absolutely and that I do not agree with Harbord's view that Hagood's scheme, even modified, should have been put into operation."

General DeWitt, who was G-4 of the First Army, has written from the Philippines, stating in no uncertain terms his disagreement with Harbord's statement.

I AM devoted to General Harbord and to General Hagood and I dislike to be in disagreement with them, but they are alone in their stand. Gen. William D. Connor left G.H.Q. and for the remainder of the War served in various important positions throughout the S.O.S. He always remained absolutely loyal to his old organization and to G.H.Q., always presenting his difficulties to G.H.Q. and accepting fully the decision which came from his old associates, all of whom were his juniors—a demonstration of the highest type of efficiency and most perfect loyalty.

I seldom think back to the World War. Personally I am intensely interested in the important problems of today and tomorrow. Somehow I got the impression that the Allies won that conflict, and that America made the victory possible.

International

The French Army Today

Newly Mechanized Units Form Its First Line of Defense

By Liddell Hart*

A VISIT to France afforded me the opportunity of renewing, after an interval of some eight years, my acquaintance with the French Army. It was also an opportunity of gauging the trend of its military thought. Such actual contact is apt to produce stronger impressions than any perusal of a country's service papers. For even in a country such as France, which has a great tradition of military literature, military ideas are no longer expressed with the freedom of the eighteenth century—that most vital age of military thought, when men like Saxe, Bourcet, and Guibert paved the way for the revolution in strategy which the young Napoleon Bonaparte was able to achieve with the leverage of the Revolution. Because of that age of fertilizing ideas, the intellectual homage of every military student is due to France. Since then, she has suffered as much as any country from the sterilzation of thought which came with the increasing professionalization of armies. It is true that in the years preceding the World War, she could still produce a Colin and a Grouard, but such minds did not guide her strategy in 1914, as history too clearly tells. Nor did the shattering experiences of the war, which at least brought appreciation of the sober common sense of a Pétain, seem to succeed in breaking the fetters on thought even to the extent that was seen elsewhere. In France, perhaps more than anywhere, the subordination that must prevail in the sphere of action was extended into the sphere of conception, with a consequent barrenness. Orthodoxy was exalted to such a pitch that it became the most powerful of contraceptives.

Thus, when I last saw the French Army, it seemed to me almost the most backward in ideas among the armies of the Great Powers. After eight years for reflection upon the experience of the last war, it showed small sign that reflection had borne fruit. Its horizon was bounded by 1918. If war should come again, it apparently intended to resume where it had left off. That was better than the cry of "Back to 1914" which had echoed in some other armies during the years of reconstruction; but they had begun to move forward subsequently, if only in thought, whereas French thought had, in general, remained stationary, despite the bold leap into the future that was made in the immediate postwar utterances of some of the leading soldiers of France. The cause may have been that in France these original ideas were sprinkled from above by generals who soon disappeared, whereas in Britain they were like springs welling up from below.

In French military doctrine and training, all else was subordinated to the production of a great volume of fire by methods that were as studiously deliberate as the rate of movement they promised. The best thing that could be said of the doctrine was that it recognized the importance of material factors, especially the effect of fire, and recanted the fallacious belief of 1914 that the unshielded will of the soldier was proof against bullets and shells. But it seemed to ignore the truth that fire is a means to movement and that the effect is lost unless it can be followed up quickly. The division was still the profusely armed but complex organ of war-time pattern. The French seemed to have conceived of nothing more than the preservation of a powerful but rigid fighting machine—a machine which was likely to break down from its own internal friction if it should ever be called upon to make a prolonged advance or retirement. I could not help thinking that the French had renovated their steam roller by fitting an extra roller but had forgotten to consider its motive power.

SINCE this visit, what I had heard from other observers had tended to confirm the impression. They spoke of the extreme deliberation of operations, of detail carried so far that it became an encumbrance. More recently, I had heard rumors of development, but not sufficient to prepare me for the change which I found. By contrast with eight years ago, it struck me as a remarkable evolution—much greater than our own in the same period. And the development has been not only in ideas but in application. If even today military thought in France does not leap forward quite so boldly as it does among the most progressive British soldiers, practical steps have been larger.

One cavalry division has already been completely mechanized, mainly with armored fighting vehicles, but has a proportion of "motor-dragoons" in light cars and on motorcycles; a second cavalry division is to be mechanized this autumn (1936). In addition, several infantry divisions have been motorized. Their artillery is all tractor-drawn and their infantry regiments are provided with small armored carriers for mortars, machine guns, and ammunition, which can themselves be moved by lorry convoy. As regards supply, it is significant that the French now consider the possibility of maintaining the divisions at a much greater distance from railhead than we have yet contemplated.

The creation of these new-type formations, so different from the rest of the active forces and from the bulk army of mobilization, is naturally leading the French toward a new picture of warfare. It tends to resemble the vision which General von Seeckt and others cast on the screen of the future during the years when the German Army was being rebuilt, although modified to suit the technical, geographical, and political conditions of France.

GENERAL mobilization is a process that works slowly in putting an army into the field; so slowly indeed, that if mobilization and concentration were made as in 1914, the army would court the risk of never reaching the field. Air

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pressure on the congested traffic arteries might cause a premature collapse. Even at the best, an interval of a week or two must elapse before these forces can come into action. But the new-type formations, helped by their special composition as well as by their rail-free mobility, may be ready within a time that we commonly count in hours. To keep them in waiting while the bulk army was assembling would be a precarious discount of the time factor, even if the enemy's action allowed the attempt.

Thus, in the new picture, the first phase of a war is fought out by the mobile forces together with the frontier garrisons. The second phase—that of conflict between the mass forces—is provided for as a possibility, although some regard it as a doubtful one. Naturally, the picture is clearer in the minds of the younger men who are now rising to positions of influence than it is in the minds of those who are filled with memories of how they conducted war in 1914-1918. But the fact of this changing outlook is unmistakable, and it has a bearing on British military problems which deserves attention.

For years, the keynote of our British military authorities has been that we should not expect to make much change in the pattern and equipment of the army until another war arrives; that it would be wiser to concentrate on being ready to go into production when the moment comes, and continue experiments meantime. That foundation of military policy has been undermined by the change of ideas abroad. To dispatch a small field force of the old pattern into a zone of mechanized operations might be to endanger its survival without compensating gain. To hold it back while it was being remodeled with equipment to be manufactured after the outbreak of war, might forfeit any effect it might have in aiding the victim of aggression. By contrast, the new situation would seem to offer the small but highly efficient army a much greater opportunity of influence than in the past. Good as the 1914 British Expeditionary Force was for its size—by human quality surpassing its slender limits—it amounted to barely one-thirtieth of the forces initially deployed in the West. But in the opening phase of a struggle where the Continental Powers relied on their mechanized spearheads, the British field force, when likewise mechanized, would be comparable in size as well as in value with the force that they could employ. If it could reach the scene in time it might thus be able to throw a preponderant weight into the scales, while its mere existence might be a deterrent to aggression when the scales are hovering between peace and war.

I HAVE spoken earlier of the modifications in the French picture produced by national conditions. They become most manifest in regard to the employment of the new-type formations. French thought revolves more than ever around the particular problem of safeguarding France against invasion—a problem essentially defensive. And French military thought inclines to share this tendency, certainly more than at times in the past. Thus the new-type formations seem to be visualized, above all, as a means of strengthening defenses—by switching fire more quickly to a threatened spot and by developing a counter-offensive more promptly. To many, there may be novelty in this "defensive" view of the value of mechanized forces. But it is justified on technical grounds.

From the contemporary point of view, it is politically as well as militarily significant that the French should be mainly concerned to fit the new development to their defensive problem—that of resisting the invasion which they apprehend. I had the impression that their ideas on this aspect were much clearer than on any wider aspects. That reflection made me cast my mind across the frontier; I thought of those who in Germany have been haunted by fear of invasion—a feeling that is widespread if not so deep-rooted as in France. If they could have shared in my contact with the actual scope of French military ideas, their fears might have been allayed. Statesmanship may suffer as much by failing to grasp what soldiers are thinking as by ignoring public opinion. The former is the more stable of the two.

It was ironically said of the Kellogg Pact that its effect was not to abolish war, but merely the declaration of war. So also, in the world today, "defense" is a conventional euphemism which embraces offense. The embrace, however, may be willing or reluctant. If one follows the trend of military thought in the different countries, one may get as shrewd an idea of the predominant attitude as in following the more fluctuating course of policy. To gauge it, one must go beneath the surface, for the offensive is so much a part of the military tradition and so much more appealing than the defensive to the soldierly spirit. On the surface of the training grounds, attack exercises predominate. Indeed, to a casual observer, the armies of the least warlike countries might well seem the most belligerent—since the more shadowy a country's military problem, the more probable that its army will spend its time in practicing the type of action it is unlikely to fulfill. Armed forces are most ruled by force of custom when dangers are least concrete. Training tends to become a truer expression of purpose when political conditions produce concrete possibilities.

THE fact that the French Army shows a firmer grasp of defensive contingencies than of offensive ones would seem a reasonable clue to the attitude of its leaders. The preponderance of the defensive finds expression in the frontier fortifications to which so much of their money and attention have been devoted in recent years. That newly fortified line, for the most part running just inside the frontier, has been widely discussed.

It consists, as is well known, of a chain of forts and casemates—the proportions varying not only according to the ground but to the money available. The "forts" themselves, according to details which have appeared, consist of a mushroom-like cluster of concrete casemates linked by underground galleries; these lead to the living quarters, magazines, and power stations which serve each cluster, and are likewise buried deep. The sector first constructed was from Longuyon, opposite Luxembourg, to the Vosges; this covered Metz and the Briey industrial area, although a gap was originally left on either side of the Sarre River between St. Avold and Bitche, where a succession of streams parallel with the frontier helped to form a natural barrier. Subsequently this gap has been filled, in part at least, and the chain of fortifications has been extended along the Rhine to the Swiss frontier to supplement this river barrier. The defense of the approaches through Belguim and Belgian Luxembourg has also been taken in hand, work being carried out along the line of the frontier towards Maubeuge and Lille. According to plan, the intervals in the chain were to be covered by the interlacing fire of the casemates, but could also be more substantially filled by field entrenchments and the whole covered by wire

entanglements. This, I believe, is now being done. Such a fortified line, although better designed, naturally lacks the depth of protection afforded by the vast trench systems which developed in the war. Stronger in meeting the first shock, it is intended to gain time rather than to be a final barrier. It is, above all, a shock absorber, to cover the process of mobilization. Its effectiveness thus depends on the adequacy and readiness of the forces which normally garrison it and on the promptness with which support can be given. The main danger lies in a surprise attack which might overwhelm a sector before the emergency was realized. A further danger now on the horizon is a penetration of the intervals by mechanized forces which might disregard the forts or leave them to be "mopped up" by a second wave of invaders.

It is for this reason that the French are so concerned with the new risks of the *attaque brusquée*. Some of them visualize the possibility of hostile mechanized forces crossing the old demilitarized zone by a swift bound during a single night and delivering their stroke early next morning. All of them now appear to realize, from this point of view at least, the great acceleration of the tempo of warfare which modern developments foreshadow.

IN 1914, a fortnight elapsed after mobilization before the advance of the main armies began. An aggressor who nowadays waited so long would have a poor prospect of gaining a decision. If this knowledge, when assimilated, may prove a powerful deterrent to aggression, it inevitably tends to focus the thought of a would-be aggressor on the ways of achieving a short-time penetration by surprise. There are some in France who fear it so much and become so absorbed in contemplation of their own risks, that they hardly pause to ask whether the possible invaders have the organization or the means to execute it. The General Staff, with their superior sources of information, preserve a firmer grasp of existing possibilities without overlooking the future.

Meantime, the problem of immediate concern is to adapt their own organization to the current of changing conditions. One need is to remodel the mobilization scheme so as to produce an effective force in support of the frontier garrisons in the shortest possible time—a time that we must now count in hours rather than in days. That mobilization scheme must also take account of the new risks threatened by hostile air attack during the main process of mobilization and concentration. Concentration must not spell congestion. It should be in the current but not on the surface. Rail and road movements must be more flexible, and the whole must be more distributed.

The other need is to develop mechanization as a means of saving time in arrival and intervention. The fortified region itself is garrisoned by units of varying composition which are "hand-made" to suit the sector allotted to them; they can be brought up to strength at short notice with reservists drawn from the neighboring district. But for the prompt support of the region and for maneuver based on this pivot, mobile formations are necessary. The need is now being met.

As a start, the 4th Calvary Division was transformed into a light mechanized division, and the 5th is now being converted. The fighting part of the division consists of what are called *automitrailleuses*—light and medium armored vehicles on tracks, which we should describe as tanks—cavalry tanks. They are all fast machines. The other part is of mixed composition to fit its mixed rôle of reconnoitering the enemy and seizing "stepping stones"; it has a regiment of *automitrailleuses,* at present on wheels, and a regiment of *dragons portés* —cavalrymen mounted in light and handy unarmored vehicles that are capable of moving across country. Each has a strong infusion of motorcyclists—a type of the troops which the French have developed notably.

In addition, some ten infantry divisions have now been partially mechanized. The artillery of these divisions is entirely tractor-drawn—light and medium lorries being used for the purpose. Compared with our British mechanized artillery it has a marked advantage for strategic road movements, owing to the fact that the guns are carried on a low trailer, from which they can be dismounted in half a minute on reaching the battlefield. By the use of these trailers, lifting the gun wheels off the ground enables the artillery to travel long distances at speeds up to forty miles per hour without damaging the delicate mechanism of the gun.

Chenillettes—armored carriers somewhat similar to the British Carden-Loyds—are being introduced in these divisions for the transport of the infantry mortar, machine gun, and ammunition. Motorization is at present only partial in the infantry, although infantrymen are commonly embussed for long moves. But several regiments have been completely motorized for the trial of a new organization.

HERE one may interpolate that the tank units, as distinct from those of *automitrailleuses,* still belong to the infantry arm. This is partly explained by their low speed, but is also due to the fact that the French have never gone back to the belief that attacking infantry, in the face of machine guns, could dispense with armored support. Realization of the difficulties of supplying the artillery with sufficient ammunition for the creeping barrages of the last war has also tended to emphasize the need for tanks. Where employed, a section to a company is allotted to aid each infantry battalion. Twenty battalions of so-called light tanks are maintained at home, but most of them are still equipped with renovated war-time machines; only two have been provided with the newer-type Renaults which weigh eleven tons (their armor being of 30-millimeter thickness) and have a maximum speed of eleven miles per hour. There is also one independent tank battalion, but the monster 70-ton tanks which were produced some years back do not seem to have given satisfaction, and the French are still looking for an efficient heavy tank of rather less weight.

The development of mechanization in the army is creating fresh problems of personnel. Thanks to the economy of time achieved by the present system of training, and to the admirable simplification of drill, the ordinary infantry attains a remarkably high standard in proportion to the shortness of its service. But it is more difficult to provide adequately trained personnel for the mechanized supporting weapons and the mechanized services in general. For these needs, the French are tending to rely on the increased professional element, which now forms a corps of specialists. Here, however, a fresh problem arises—not only how to recruit sufficient numbers but how to recruit a sufficiently high grade of man. The trend of modern warfare emphasizes the importance of finding a solution. For the unskilled man, in the services as in industry, is losing his utility. Quality outweighs quantity on the modern battlefield, for swift action demands trained men.

Tanks and Tactics

A Discussion of Mechanization and Automotive Ordnance

By John K. Christmas*

THIS article deals with mechanization and automotive ordnance. Mechanization is the latest idea in military tactics and automotive ordnance the means of carrying out this idea. The subject, therefore, is developed in that order, but automotive ordnance is the principal topic because it embraces the development of the track-laying vehicle and other engineering in which most readers of ARMY ORDNANCE are interested. This paper attempts to acquaint the reader briefly with the Army's problems in fighting vehicles; what we have done and what we plan to do, in the hope that thereby we may obtain a still greater measure of that fine coöperation from industry which has been and is essential to our work. You are regretfully reminded that for reasons of public policy and national defense, most of the latest developments and engineering problems are not discussed in detail. Much important automotive work is being done currently for the Ordnance Department by firms in industry; in fact, while most design and development work is done by the Department, most ordnance automotive production is done by private industry.

COMPARISON OF LOGISTIC DATA OF TWO UNITS OF APPROXIMATELY EQUAL FIRE POWER

	Mechanized Cavalry Brigade	*Horsed Cavalry Brigade*
Strength—Men	2346	9275
Animals	—	10,714
Vehicles (all kinds)	771	910
Class I supplies for 1 day (tons)*	81	92 (less 75 tons hay)
Gasoline and oil for 1 day (tons)	76	15
Mobility factor (miles of travel per ton of Class I supplies)	1.84	0.27 (less hay)
Length of column (miles)	14.2	19.2
March per day (miles)	150	25
Day of fire (tons of ammunition)	140	157
Firepower per man (lbs./man)	120	34
Standard R.R. trains for a movement	14	57
Ship ton for overseas	25,000	135,000

**Class I Supplies: Food and fuel for men, animals and machines; i. e., the raw material of mobility.*

TABLE I

The three elements of combat are fire, movement, and protection. Originally, primitive man fought with the fire power (fists), the mobility, and the protection built into his body by nature. When primitive man started to use a club instead of his fists he had taken the first step to *mechanize* his fire power; that is, he had augmented his inherent fire power by the use of a tool or external device; similarly, the use of a shield and a horse were, respectively, steps in the use of tools to mechanize or augment his protective power and his mobility. Without reviewing the familiar gradual development of these three primary elements of combat, attention is invited to the fact that at the opening of the World War in 1914, fire power had been very highly mechanized, as embodied in machine guns and fast-firing, high-powered artillery. However, it will be noted that the two other elements of combat—protection and mobility—had by the time of the World War lagged very far behind the development in fire power. In fact, the development of battlefield mobility and protection virtually had stood still for hundreds of years. That is, the majority of the fighting men were still wholly muscle-propelled on the battlefield, and unprotected except for a "tin hat" or steel helmet and the stationary protection of earthworks. The major lesson of the early years of the World War was that due to the very superior development of fire power as compared to the two other elements of combat, the defensive had become so strong that battlefield maneuver and attack were practically impossible, resulting in a virtual stalemate in 1915.

A few superior minds in England, including Winston Churchill (then in charge of the British Navy), revived the ancient idea of the battle chariot. Two nonmilitary inventions made the revival of the "battle wagon" practicable; namely, the internal-combustion engine and the track-laying or crawler-type tractor, the latter perfected commercially by Holt, an American. The mission of the first British battle chariot (known then as a land ship, but later named "tank" for reasons of secrecy) was to transport the fighting soldier, his arms and ammunition *safely* across the fire-swept No Man's Land to engage the enemy decisively in his trenches. This safety was accomplished by surrounding the soldier with armor. Since the necessary protective armor was too heavy for the soldier to carry, he, his weapons, and the armor had to be carried on some sort of mechanically propelled vehicle. Wheeled vehicles—motor car chassis—were first tried for this, but the resulting armored cars were found largely inadequate because their wheels restricted them to operation on roads and hard, even ground. The next, and logical step, was to transport the fighting man, his weapons, and armor into battle on an automotive vehicle capable of moving across practically any terrain. *This suitable vehicle was the track-laying agricultural tractor.*

IN a study of the development of armored combat vehicles, it is highly important to remember that mobile protection, the initial mission of the tank, is still its primary mission, that is, to carry the fighting soldier and his fire power safely across any type of ground to engage the enemy. The tank, or other fighting vehicle, is thus a complete weapon embodying balanced integrated elements of fire power, mobility, and protection, all brought to their highest perfection by modern engineering and science. The various mechanical components of such a fighting vehicle are, in a great measure, predicated on similar or parallel scientific or industrial developments. The primary problems of the ordnance engineer in designing these special fighting vehicles are the proper balancing, synthesis, and integration of the various mechanical components into the complete vehicle so as best to meet the tactical (or fighting) requirements. Further, the ordnance engineer must develop, or lead the development of those special components which

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FIG. 1. THE LIGHT TANK NOW IN CURRENT USE IN THE ARMY

FIG. 2. THE CONVERTIBLE, WHEEL-AND-TRACK, MEDIUM TANK

have no commercial counterpart; that is, high-speed tracks, suspensions for high-speed track-laying vehicles, high-speed track-steering mechanisms, armor plate, armament, and special engines.

The question naturally occurs at this point: Did tanks amount to anything in the World War? Mechanically, the World War tank was about on a par with the airplane of that time; tactically, being much newer than the airplane, it did not develop as fast and still lags considerably. Apropos of this, let me quote Admiral Mahan, the American naval historian:

"The student will observe that changes of tactics have not only taken place after changes in weapons, which is necessarily the case, but that the interval between such changes has been unduly long. This doubtless arises from the fact that an improvement of weapons is due to the energy of one or two men, while changes in tactics have to overcome the inertia of a conservative class; but it is a great evil. It can be remedied only by a candid recognition of each change."

While Admiral Mahan was referring to new developments in naval weapons, what he wrote applies with equal force to new land weapons, including tanks, and in a measure to all new machines and ideas.

French records, based on the 4356 tanks of various sorts in battle from April, 1917, to the Armistice, show that tank losses due to enemy action averaged seventeen per cent per attack. Further, and more important, only 302 tank crewmen were killed in all these actions; the percentage of killed was 13.2, which is about one-half that of muscle-propelled infantry in similar attacks. Lastly, one of the best indorsements of the tank is that Germany, the only nation which continually fought *against* tanks, is now seriously mechanizing her newly rebuilt army.

IT may be of interest to see briefly how mechanization affects the two major national factors necessary to fight a war—men and machines. Mechanization is labor-saving machinery applied to one of the oldest professions, fighting. It means getting the same result by using less men and more machines, with a resultant lower cost of production, just as in industry. But in war, the cost of production is the whole cost of victory or success for our national policy. Believe it or not, as Mr. Ripley says, *in war, men are the most expensive factor*. Each soldier must be recruited, trained, equipped, and maintained; if he becomes a casualty there are the just and necessary direct monetary expenses of insurance, hospitalization, and pensions, to say nothing of the intangible losses to the nation from these casualties. On the other hand, when a tank becomes a casualty, or there is no further use for it, it can be scrapped and the account closed. Counting *all* costs, it can be stated conservatively (and shown) that each combat soldier costs the Government ultimately about the same as a light tank produced in quantity. But regardless of one's tactical views, there can be no serious question that a tank has the fighting power of several, if not of many, soldiers. Hence, it pays to fight with machines instead of with men, so far as it is practicable to do so.

COMPARATIVE COSTS OF EQUIPMENT
(Typical Comparable Units)

ITEM	*Infantry Regiment*	*Tank Battalion*	*Ratio*
Cost of all equipment	$270,000	$2,050,000	1–7½
Cost of ordnance equipment	$169,000	$1,500,000	1–9
Cost equipment per man	$ 90.00	$ 3,850	1–43
Cost of ordnance equipment per man	$ 55.00	$ 2,800	1–51
Weight of ordnance equipment	35 tons	495 tons	1–14
Weight of ordnance equipment per man	23 lbs.	1,780 lbs.	1–77

Since it may appear from this chart that mechanization of the Army is too expensive, the following chart has been prepared to show the cost of mechanization on the ground with the older and accepted mechanization in the air and on the water.

EQUIPMENT COST PER MAN

UNIT	*Approximate Investment Per Man in Crew*
Tank	$ 6,250
Pursuit plane	25,000
Bombing plane	15,000
Battleship	25,000
Submarine	50,000

TABLE II

Let us examine a few facts giving some pertinent comparisons between a muscle-propelled and a mechanized military unit having approximately equal fighting or fire power. I have taken for this purpose a horsed cavalry division and a mechanized brigade. Minor changes in organization and equipment change these figures somewhat from time to time, but the *relative*, or comparative, values are generally like those shown for the two types of units in Table I. Particular attention is invited to the much smaller number of men in the mechanized unit, which means less casualties, the greater "mobility factor," and the greater fire power per man engaged in battle. Most of all, let me stress the fact that in the mechanized unit only one-fourth as many men are exposed to casualty as in the muscle-propelled unit, and it is the casualties (both dead and wounded) that represent the highest cost of war, both in money and in human values. Mechanization lets the machine do most of the dirty work of war, while more men stay at home to produce the greatly increased number of fighting machines required. That this is the prospect for the next war is shown by the following quotation from the 1935 annual report of Gen. Douglas MacArthur, then Chief of Staff of the Army:

"Additionally influencing the determination of the War Department to emphasize quality rather than quantity in further development of the Army, is the conviction that relatively small forces exploiting the possibilities of modern weapons and mechanisms will afford in future emergencies a more dependable assurance of defense than will huge, unwieldly, poorly equipped and hastily trained masses. . . . But it will be a nation at war, rather than a nation in arms. Of this vast machine, the fighting forces will be only the cutting edge; their mandatory characteristics will be speed in movement, power in fire and shock action, and the utmost in professional skill and leadership. Their armaments will necessarily be of the most efficient types obtainable, and the transportation, supply, and maintenance systems supporting them will be required to function perfectly and continuously. Economic and industrial resources will have to assure the adequacy of munition supply and the sustenance of the whole civil population. In these latter fields the great proportion of the employable population will find its war duty."

Before leaving this brief survey of mechanization I want to

TYPES OF AUTOMOTIVE VEHICLES AVAILABLE FOR COMBAT PURPOSES
ARRANGED IN ORDER OF TACTICAL OR "OFF-ROAD" MOBILITY

TYPE	*Tactical Mobility Off Road and Speed**	*Strategic Mobility On Road*	*Cost*	*Commercial Availability or Status*	*Status of Development*	*USE*
1. Special Full-Track Tank or Tractor	E-20	Good	High	Poor	Good	Tanks and Combat Cars
2. Commercial Tractor	E-5	Poor	Low	Excellent	Excellent	Prime Movers†
3. Convertible (Wheel and Track) Tank	E-20	Good	Very High	Poor	Fair	Tanks and Combat Cars
4. Portée (Truck and Tractor)‡	G-5	Good	Medium	Excellent	Excellent	Prime Movers†
5. Half-Tracked Vehicle	G-20	Good	Medium	Poor	Fair	Prime Movers† and Transport
6. Multiwheel-Drive Truck	F-20	Excellent	Medium	Fair	Good	Armored Cars and Scout Cars
7. Two-Wheel-Drive Truck	P-20	Excellent	Low	Excellent	Excellent	Scout Cars

Symbols: E, excellent; G, good; F, fair; P, poor.

**Maximum tactical speed given at 20 miles an hour, as that is considered the maximum practical speed across country.*
‡Portée refers to the use of a commercial tractor for tactical mobility, the tractor being carried in a truck when on roads; such a combination can be used for the draft of field artillery.
†For pulling artillery.

TABLE III

invite your attention to the reorientation that this new development has made in the demands of the Army on industry: not only is much more fighting equipment required per man put into battle, but the demand for automotive fighting vehicles, mostly of the track-laying type, becomes really enormous. It is with the development of these fighting vehicles that this paper is principally concerned. And since it is our automotive industry that must supply these fighting machines, it is worth noting briefly how closely the military idea of mechanization affects industry, now and prospectively. Table II shows, for example, the increased demands for equipment when a muscle-propelled, or ordinary infantry regiment is replaced by a mechanized (or tank) unit of approximately equal fighting power.

Note that practically all the increase is in ordnance, or fighting equipment, and further, that most of the increase is in fighting vehicles; that is, in track-laying machines which are essentially fast armored tractors. When we remember that there were on order for the American Expeditionary Force in November, 1918, some 22,000 tanks and 25,000 artillery tractors, it readily can be seen that in a future major war our demands for track-type vehicles of all kinds will run into the hundreds of thousands.

Taking up now the subject of automotive ordnance, let me say that the automotive problem of the Ordnance Department is to design, develop, procure, and maintain all combat vehicles and all track-type vehicles required by the Army. (A "combat vehicle" is any motor vehicle on which are mounted arms and/or armor.) Remembering that the primary quality required in a fighting vehicle is ability to operate away from improved highways, all available types of automotive vehicles may be divided into seven principal classes with respect to their off-road or tactical mobility, as shown in Table III.

REFERRING to this table, it will be noted that classes 2, 4, 6, and 7 are almost entirely commercial developments, so that in these categories the Army can rely for its military needs on the greatest automotive industry in the world. However, while all the qualities listed in the table are of importance from a military standpoint, and while all of these qualities must to some extent be integrated into the selection of types to be used for combat vehicles, it is a fact based on long experience that the first column (tactical mobility) is far more important than all the others in a first-class fighting machine. Therefore, only the first three classes can be used for combat vehicles, that is, for tanks and combat cars. (A combat car is virtually a tank made for cavalry operations.) Worse yet, of the three classes having excellent tactical mobility, only two classes (1 and 3) have that mobility combined with the necessary high speed—*and these two classes are not now commercially available.* Further, experience and tests have conclusively demonstrated that tracks are essential to full battlefield mobility. The development of high-speed track-laying vehicles is thus the special province of the ordnance engineer; we hope that before long the tractor industry will at least share this responsibility with the Ordnance Department. We thus see here a case where the Army is leading into new fields of development. Contrary to popular opinion, this is quite often the case, for the first business of a nation, as of an individual, is to survive. Lewis Mumford, no particular friend of the military to judge by his important work, "Technics and Civilization," says therein: "Perhaps the most positive influence in the development of the machine has been that of the soldier; in back of it lies the long development of the primitive hunter." Certainly the World War gave considerable impetus to the tractor, the truck, and the airplane industries.

The tank, as already stated, was developed during the World War, based on the internal-combustion engine and the commercial track-laying tractor. It is interesting to remember that the tank, while pioneered by the British, was independently developed by the French Army. Such independent parallel scientific developments occur more frequently than is generally recognized. The year 1918 saw tanks with a maximum speed of about six miles per hour; weight up to forty-five tons; a mediocre mechanical reliability and a mileage life of twenty-five to about one hundred miles between major mechanical overhauls. Since then, in all industrial nations, by private industry and by the military services, thousands of developments have been undertaken to improve the tank and other fighting machines. That this development has been attended by considerable success is shown in Fig. 3. Since

the armor plate constitutes by far the major part of the "pay load" of the tank, this chart may be considered as a record of the development of pay load versus maximum speed. I believe the peak of the speed development has been reached. Since tank hulls or bodies are, as a rule, fairly similar in shape and in arrangement of plate, the maximum thickness carried may be taken as an index to the protective value of the whole tank. Therefore, these curves show that there has been a great improvement (or reduction) in the weight per horsepower of all the propulsion elements of the tank and in the general efficiency of the tank as a fast carrier of armor plate; *i.e.,* modern tanks can go faster and still carry more armor.

What this chart does not and cannot show is that there has been an even more remarkable increase in mechanical reliability and in mileage life; so that now a tank may be expected to run for several thousands of miles without any mechanical failures. To accomplish this great improvement very few stones have been left unturned: practically every type of engine has been tried; suspensions even a Rube Goldberg couldn't think of; tracks of shapes and materials without number. The result is that today the armies of the world have tanks ranging in weight from 1½ to 141 tons; with tank crews from 1 to 17 men; speeds from 5 to 50 miles miles per hour (on tracks); armor from one-eighth to 2 inches thick; tank guns from light machine guns to 6-inch guns. Certainly it can be expected that tanks, following the example of other weapons, will become specialized as to the purpose for which they are to be used, and will also become much larger.

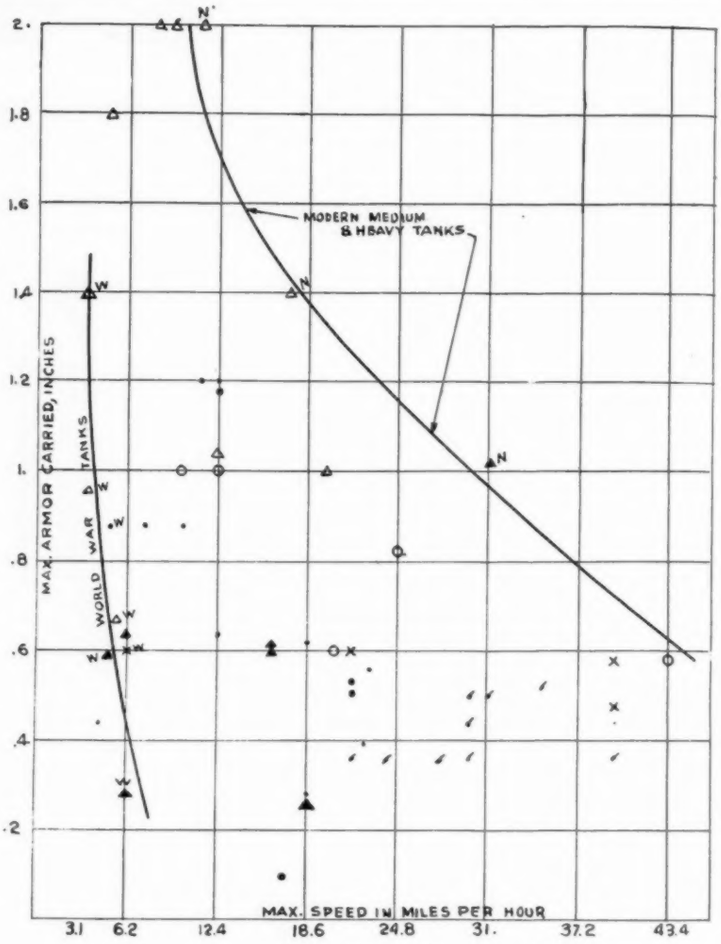


FIG. 3. TANK ARMOR VERSUS MAXIMUM SPEED

LET us now take up the design of a modern tank. First, it is axiomatic that it must be a full-track-laying machine, in order to have maximum cross-country mobility. Secondly, the

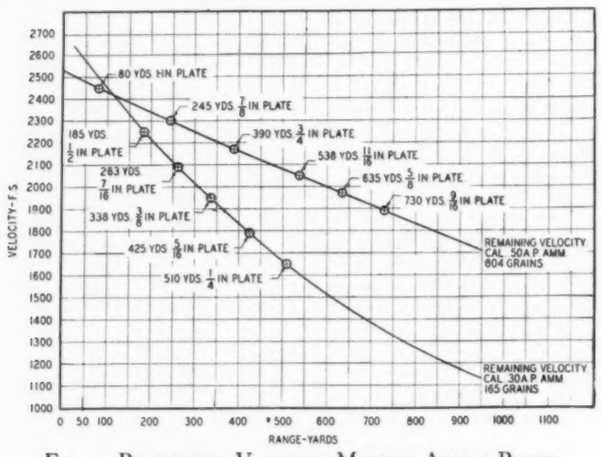


FIG. 4. PROTECTIVE VALUE OF MODERN ARMOR PLATE

pay load: since the crew and weapons weigh but a small per cent of the whole tank, the real pay load becomes the armor, for, as discussed previously, the armor is the tank's principal asset—its *raison d'être.* Armor plate one inch thick weighs forty pounds per square foot. The armor plate represents a dead load of fifteen to forty per cent of the gross tank weight. The protective value of good modern armor plate is shown in Fig. 4; no startling improvements in the protective value of armor plate reasonably may be expected.

Thirdly, we must consider reliability. Needless to say, this nearly always means still more weight. The requirements for speed, armor, and armament, preclude building into a tank or other special military tractor the mass stamina found in commercial tractors. However, at considerable expense, much can and has been done to increase reliability (with no increase in weight) by the use of alloy steels, forgings, aluminum, and special heat treatments.

Fourthly, speed: To get the high speeds now demanded requires the use of high-speed, light-duty, expensive engines not otherwise proper for heavy tractors. Due to the great expense of developing special engines and to the limited funds available, it has been the policy of the Ordnance Department to use in combat vehicles commercially available engines, modified as necessary. This has some engineering disadvantages but has one big advantage—quick availability in quantity in time of war.

Further, the high vehicle and track speeds greatly complicate the problems of reliability and reasonable mileage life. The resulting tank design is necessarily a compromise in which the importance of the various factors varies with the tactical or fighting mission prescribed for the machine. Un-

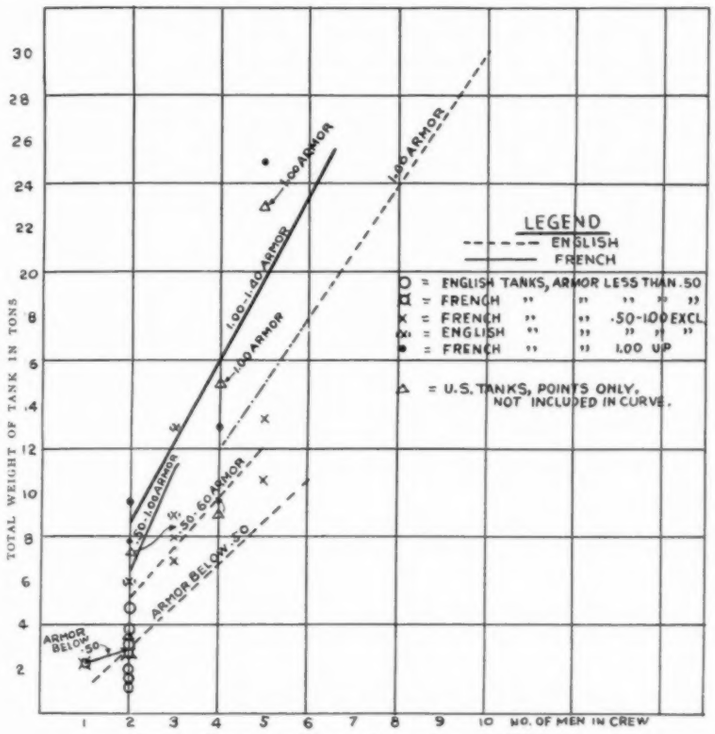


FIG. 5. RATIO OF TANK CREW SIZE TO WEIGHT

fortunately, since the development of modern tank tactics necessarily had to await the development of fairly satisfactory track-laying chassis (you are here referred to Admiral Mahan's quotation above), there are still several schools of thought as to the proper tactical employment of tanks. Therefore, there are still many divergent ideas as to the compromises to be made by the tank designer among speed, weight of armor, reliability, mileage life of the machine, and other qualities. Probably it will take another war to settle completely some of the debatable and debated issues in tank design (Figs. 5 and 6).

THE modern tank, or any track-laying chassis for combat purposes where high speed is required, consists specifically of the following units:

Engine: A light, high-speed engine of great power, since future tank speeds (on tracks) up to fifty miles per hour require a ratio of horsepower per ton of vehicle weight of thirty or more (Fig. 6). Commercially available engines, modified somewhat for war use, are the ideal solution sought by all armies.

Transmission and clutches: Commercial types generally as to design, but in tanks, the gear ratios required and the large torque to be transmitted usually exceed anything available in stock automotive transmissions. Aluminum-alloy cases are desired for lightness; a combination of sliding gears and jaw clutches is used with manual shifting; four or five gear speeds are generally required because of the wide operating range of the vehicle—from two to forty or fifty miles per hour. These transmissions are lubricated with a heavy engine oil which is pump-circulated, and may require cooling by an oil cooler external to the transmission.

Clutches: Generally multiple dry plate, foot-operated.

Steering: Effected, in high-speed machines, by a modification of the controlled-differential type used in some slower-speed American commercial tractors. The application of a steering brake to one side of the controlled-differential type results in the two tracks being driven through the differential at different speeds fixed by gear ratios. This type of steering will not give the sharp and pivotal turns that can be had with the more conventional steering clutches and steering brakes, but is adapted to frequent small applications of steering; this type of steering also lends itself better to the steering of a sinuous course sometimes preferable at high speed, rather than a composite vector course such as is taken by a machine using steering clutches. Controlled-differential steering, partly by virtue of its slower action, decelerates the vehicle less when turning than the clutch types of steering. The heat generated in steering large track-laying vehicles at high speed is still a problem, as is the matter of a lining satisfactory for the high peripheral speeds of the steering brakes.

Suspension: The tank must provide a fairly steady gun platform when operating over rough ground at high speeds; this requires a well-articulated spring suspension having a quick-acting inherent damping generally proportional to amplitude of the oscillations of the chassis. The most satisfactory suspension to date has been found to be a two-wheeled bogie whose track wheels are carried by a link system working against springs. The link system used must provide the necessary large individual vertical wheel movement, while the springs provide the action with inherent damping proportional to the movement of the spring.

Drive: On high-speed track-type machines the tracks are sometimes driven from a sprocket at the front of the vehicle instead of in rear, as is conventional in a commercial tractor. The front drive is used in tanks, but it should be noted here that the tank has only itself to propel and is not a prime mover. It it considered that the track driven in front, due to absence of tension on the part in contact with the ground,

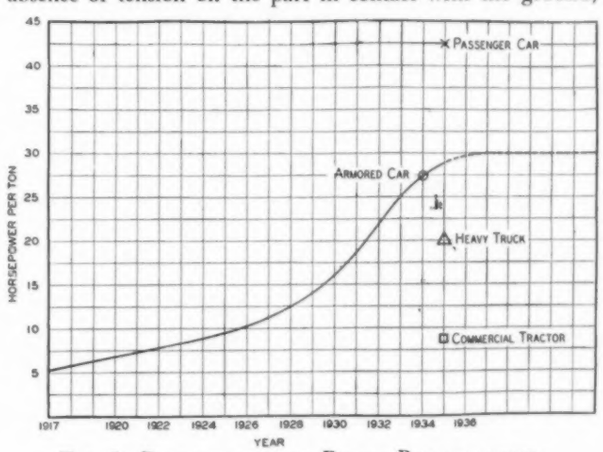


FIG. 6. DEVELOPMENT OF POWER REQUIREMENTS IN TANKS, 1917-1935

obtains full-contoured ground contact so as to get maximum flotation and maximum traction. A track so driven is claimed by its advocates also to clean itself of dirt better and to climb obstacles more readily. Further, a front drive allows locating

the engine in the rear. This makes possible a crew compartment in the front, where it should be for maximum visibility of the ground.

Tracks: These are last but by no means least. Articulated steel tracks, steel-pin connected, have been developed to the point where they can be relied upon for thousands of miles of satisfactory operation at low speeds; and while such steel tracks are no doubt superior where maximum traction is essential, steel tracks have been found inadequate for higher-speed operation for a number of reasons. They wear out too quickly, they have a high rolling resistance, they are very noisy, and they injure an improved highway. Rubber resists abrasion much better than steel and besides has an inherent elasticity, both of which qualities largely make possible the modern automobile. Shortly after the World War, both here and abroad, many efforts were made to use rubber in tracks for track-laying vehicles. Recently, the American rubber industry has developed its technique to the point where it is possible to vulcanize rubber to and around a steel track link in such a manner that the rubber can carry the weight of the tank and also take the abrasion of traction on the road. Several developments involving the use of rubber in tracks are now active in the rubber and tractor industries.

Summarizing this brief analysis of a modern military track-laying machine, it may be stated that high-speed track-laying machines capable of sustained highway speeds of over thirty miles per hour can be made; in addition, such vehicles, being track-layers, are capable of traversing practically any type of cross-country terrain. Further, such machines are reliable and durable for thousands of miles. While a comparatively short mileage life is probably satisfactory for war purposes, for peace use and for commercial use some improvement is, of course, desirable. A high-speed track-type machine, such as the tank, is the primary fighting vehicle of the future (and I believe the primary land weapon), but it needs refinement. It needs most of all to be adopted commercially in order that it may be perfected more rapidly and more easily become available to our Army in time of war. Fig. 1 shows the light tank, a type in current use in the Army.

NO discussion of track-laying machines would be complete without mention of the convertible, or wheel-and-track tank. This machine is primarily a track-type tractor, so constructed and provided with wheels that for operation on improved highways it operates as a wheeled vehicle. This idea has been developed with considerable success in various forms in several countries, notably Sweden, Russia, Great Britain, and the United States. Basically, such vehicles have these handicaps: from an engineering standpoint, the low efficiency and excess complication inherent in any two-purpose or general-purpose machine; and tactically, the considerable time involved in the change from wheels to tracks or vice versa. However, like the amphibian airplane, a limited and special field will probably always exist for the convertible tank. Fig. 2 shows an example of the convertible principle in this type of vehicle.

Knowing that high-speed track-type machines are essential in large quantities in an emergency, many efforts have been made by the Ordnance Department to secure a cheaper and more readily available vehicle. This effort has resulted in the development of the half-track truck, which is simply a light commercial truck chassis in which there has been substituted for part of the rear axle and the rear wheels two simple suspensions carrying articulated tracks; these tracks carry the rear end and propel the vehicle, giving it much added traction and flotation. Such a vehicle, in small quantities, costs about twice what a truck costs; it is available rather quickly, and it has a cross-country performance considerably better than any wheeled vehicle, particularly on soft ground. A very limited commercial source and market now exist for these vehicles, and it is to be hoped that this market will expand. Such vehicles are much used in foreign armies, notably the French. Several American firms are assisting in developing such half-track trucks and various tracks for them.

Half-track trucks are used for the draft of light artillery, for wire-laying machines, for machine-gun carriers, personnel carriers and other transport purposes, where battlefield or tactical mobility is essential. Speeds up to 40 miles per hour can be obtained, with a track life of 4000 miles and better. This may not have much commercial appeal, but it has great military value, because in war, performance comes first and cost second. There is good reason to believe that the track life can be greatly increased.

NOW a word about operating costs and maintenance: It can be said fairly that while these may be high by commercial standards, the performance demanded is also high by those standards. Further, the cost per mile and the maintenance required are being reduced constantly. The principal item of operating cost is the cost of tracks; at present the cost of operation of a tank per mile is, in general terms, about that of an airplane.

Before closing this review of automotive ordnance, let me mention briefly the principal problems remaining. They are: first and foremost, to get the high-speed tractor adopted commercially, so that industry will assist us even more than it has already done in developing the fast track-type machine, thus quickly and cheaply making available large numbers of such machines in time of emergency. Specifically, and technically, we need longer-lived tracks; a better high-speed steering system; cheaper engines; a Diesel engine for safety, fuel economy and low-speed torque; and finally, better and cheaper armor plate.

In closing, I wish to summarize mechanization and automotive ordnance as follows:

1. The mechanization of all armies is occurring at an ever-increasing rate.
2. It is cheaper to fight with machines than with men.
3. Mechanized fighting vehicles demand fast (twenty miles per hour or more) *track-type* chassis.
4. The tank is being increasingly recognized as a major weapon of land warfare.
5. Fast full-track-type and half-track vehicles that are reliable and of fair mileage life have been developed and are being specially built for military purposes.
6. The wheeled automotive vehicle, due to its inferior cross-country mobility, has only *a very limited field* as a fighting vehicle.
7. The military demand for fast tractors will, I hope and believe, have an influence toward higher tractor speeds commercially, with resultant mutual benefits to industry and to the national defense.
8. American automotive ordnance compares very favorably to that now in use by the armed forces of foreign nations.

Private Manufacture of Arms

The Report of the British Royal Commission of Inquiry

By Sir Charles Petrie*

THERE has recently appeared in England a document which should be read by all intelligent citizens in every country; namely, the Report of the Royal Commission appointed by the British Government to inquire into the private manufacture of, and trading in arms. It is safe to say that not for many years has there been put on the market an official publication containing so much sound common sense, or so conclusively refuting the arguments dear to the pacifist and the crank.

The Commission was appointed in February, 1935, and it owed its origin to an agitation in Parliament and elsewhere against the private manufacture of armaments. This campaign was conducted primarily by the Socialists, who desire the nationalization of all industries, with the assistance of some well-meaning, but muddle-headed Conservatives and Liberals, and such organizations as the League of Nations Union. Insofar as this movement was not of a partisan nature, it was typical of a confusion of thought by those whose hatred of war blinded them as to its causes. In the previous year the so-called Peace Ballot (one of the biggest ramps in recent British political history) had taken place, and ninety per cent of those who participated in it had voted in favor of the abolition of the private manufacture of arms. With Germany and Italy occupying a great deal of its attention, and a general election due in a few months' time, the British Government decided to put the question into cold storage until a more appropriate season. Accordingly, the Royal Commission was set up, and the weight and impartiality of those appointed to serve on it cannot be questioned by any fair-minded person. The chairman was Sir John Bankes, a retired Lord Justice of Appeal, and the other members included Sir Philip Gibbs, the well-known author and journalist; Mr. H. C. Gutteridge, K. C., a lawyer with an international reputation; and Mr. J. A. Spender, the Liberal publicist who was for so many years editor of the *Westminster Gazette*. There was also one woman, Dame Rachel Crowdy, who did so much for the nursing services during the war. It is their unanimous report which has now appeared.

There is certainly no ambiguity about the conclusions at which the Commissioners arrived:

"The abolition of the private industry in the United Kingdom and the substitution for it of a system of state monopoly may be practicable; but it is undesirable. We believe that the reasons for maintaining the private industry outweigh those for its abolition. We are of opinion that the necessities of imperial defense cannot be effectively met, in existing conditions, except by the maintenance in peace time of a system of collaboration between the Government and the private industry of the country in the supply of arms and munitions."

THERE can be little doubt but that in reaching this decision the Commission was influenced by the progress of events while it was sitting. In the early months of 1935 the ordinary Englishman was still under the illusions which he had cherished since the Armistice: a war in which he might be implicated was unthinkable, and in any event the League of Nations, with its machinery of collective security, was his sure shield. Eighteen months later the situation was very different: the League was in ruins, collective security had been proved a sham, Mussolini was master of Abyssinia, and the sword of Germany seemed already halfway out of the scabbard. Thus the Commissioners concerned themselves not so much with the refutation of pacifist arguments, except incidentally, as with an examination of the existing machinery for the production of armaments in the event of a crisis.

The Report very wisely takes into account the moral objection advanced against the private manufacture of arms but regards it as "to some extent a projection of the moral objection that is felt towards war itself." Moreover, if it is wrong for a private individual or company to make armaments, then it is equally wrong for the State to do so: no distinction can be drawn on ethical grounds. On the other hand, the Commissioners are of the opinion that "the responsible heads of firms and directors of public companies need to be reminded of the essential difference between the trade in armaments and ordinary commercial business", and there is a reference to "the frivolous and cynical language" which some of them are alleged to have used. It is difficult to resist the conclusion that these passages have been included as a sop to the sentimentalists, to whom the rest of the Report gives no ground for satisfaction. The pacifists were obviously on their best behavior when they appeared before the Commission, because no single witness openly asserted that any British armament manufacturer has directly endeavored to disturb international relations or pursue a policy hostile to disarmament. This is by no means the line always taken on the platform or at the street corner, but it is very significant when it is remembered that among those who gave evidence were such bodies as the Communist Party, the Independent Labor Party, the Union of Democratic Control, and the British Movement against War and Fascism.

TURNING from the negative to the positive, the Commissioners base their belief in private enterprise on the fact that it provides a reserve of manufacturing capacity to which the Government can turn in the event of war: "The Navy experienced no serious shortage of supplies in the late war, because the Navy had placed orders with the private firms regularly in peace time." It was found upon examination that a good many of the witnesses who advocated nationalization did so because they believed such a policy should be applied to all branches of industry, not because they had any special knowledge of the problem under discussion. Above all, nationalization would necessitate an expenditure out of all proportion to the result obtained. In short, the Commissioners felt that the moral objection to private manufacture was beside the point, while on practical grounds the arguments were all for its continuance.

The Report goes on to deal with the "evils and objections

*Foreign Editor, *The English Review*, London.

to which private manufacture is alleged to be open", and the paragraphs in which these are discussed are by no means the least illuminating. It appears that some fifteen years ago the League of Nations sponsored an announcement to the effect that armament firms were in the habit of seeking to influence policy in the most improper manner, and on this charge most of the subsequent allegations of a similar nature have been based. The present Commission now places it on record that the League "did not investigate the question of the existence of these evils." This is not the first time, it may be observed, that Geneva has proved to be the source of unfounded accusations. The Commissioners found no evidence, so far as British armament manufacturers were concerned, in support of these allegations. "We are not persuaded," they say, "on the evidence before us that British armament firms are guilty of having been active in fomenting war scares or of persuading this country to adopt warlike policies and to increase its armaments. We do not believe the armament firms attempt the bribery of Government officials in this country." Nevertheless, the Commissioners consider that even the appearance of evil should be avoided, and they advise that naval, military, and air force officers, whether serving or retired, should not enter the employment of armament firms without special permission.

THE next problem considered is international control of the trade in arms, and the section dealing with this begins with the somewhat melancholy reflection that the question "has engaged the attention of succeeding committees and commissions at Geneva, with varying success, over a period of more than fifteen years." Nevertheless, the Commissioners, somewhat against their better judgment one suspects, do not abandon all hope of the League effecting something, and they are careful to do it that lip service without which no official British pronouncement is now complete. Accordingly, they declare themselves impressed with the Draft Articles submitted by the United States delegation to the Disarmament Conference in May, 1934, which they define as "to provide for national control over the manufacture of and trade in arms under international supervision, including inspection on the spot; there would, under the proposals, be full publicity of all manufacture, publicity of orders, strict licensing of all exports and imports and licensing of manufacturing." With the example before us of what has been going on in connection with the Spanish civil war, it is not easy to see Germany, Russia, and Italy agreeing to such conditions. However, the Commissioners are nothing if not optimistic, and they declare, "we are of opinion that this country should continue to promote and encourage the adoption of measures for the international regulation and control of the manufacture of and trade in arms." This is certainly the most unpractical section of the Report, however admirable the sentiments expressed.

From these pious aspirations the Commissioners pass to a matter of the greatest importance at a moment when rearmament is the preoccupation of the British Government; namely, official regulation and control of private industry. They come to the conclusion that in the interests of the nation nothing less is required than control by the Government in peace time of all armament manufacture and manufacturing capacity in the kingdom. The reasons given for this decision are three in number: To insure rapidity of expansion at a time of emergency; to check prices and establish a planned system; and to prevent the possibility of profiteering in time of war or other national emergency, and in this way to eliminate the incentive to those objections which have been made to the system of private manufacture.

THE consequent recommendation is of such topical interest that it deserves to be quoted *in extenso:*

"In principle, we think there should be established by the Government a body for the purpose of controlling supply and deciding questions of priority. Such a body should have executive, and not merely advisory powers over supply, manufacture, costing, and the authorization of orders from abroad. It should be presided over by a minister responsible to Parliament. Its main duties would be the consideration and the decision of all questions of supply and manufacture in peace time, the preparation in full detail of the regulations and plans for emergency expansion by coöperation between the Government establishments and private industry, the encouragement and development of scientific research, costing, and the control of prices, and the inspection and the authorization of all orders received from abroad by armament firms. We recommend further that the Government's own manufacturing establishments should be fully equipped for the production in some measure of naval, military and air armaments, that they should specialize in scientific research, that they should be responsible for the training of technical experts, take the initiative in the production of designs and improvement of machine tools, and the formulation of mass production methods not only for their own manufacturing requirements, but for the use and instruction of the private industry of the country in time of emergency. By this means the Government establishments would, in cases of emergency, be ready with the specifications, gages, and particulars of machine tools necessary for rapid expansion by private firms. They would provide standards by which costs could be checked. They would develop instruction in mass production methods and would have a trained personnel available for service as instructors in times of emergency. They would no longer have to rely entirely, as they do at present, upon private armament firms for any types of weapons, and would be fully equipped for such production. They would therefore take a more important place than they now occupy in the national system of defense, and would be in a better position to serve the nation in time of emergency, when private industry is placed under a strain of expansion not yet within its powers to fulfill, or when some international limitation of arms may induce private industry to restrict or even abandon its present range of manufacture."

From an internal British standpoint, this suggestion is of great importance and has been hailed by the press as easily the most constructive in the Report. Its adoption would imply the creation of a permament Ministry of Munitions, presumably in addition to the Minister who coördinates the three fighting services—at present Sir Thomas Inskip. It is to be regretted that the Commissioners were not more precise, though on their behalf it must be admitted that the whole position was changed while they were actually sitting. When they were appointed, mention of rearmament was as well received in official circles as an improper story in a Victorian drawing-room; when they reported, it was the most blessed word in the dictionary. The danger is that the official mind will rush from one extreme to another, and from no depart-

ment being interested in preparation for war we shall find ourselves with several competing authorities. The obvious solution would appear to be a Minister of Defense, but that is a problem which the politicians have so far displayed a rare unanimity in refusing to face. The Commissioners may have had their own reasons for their discretion, but it is to be regretted that they were not more outspoken, in which case they would have stimulated a very valuable controversy. However that may be, further point has been given to the recommendation by the dispute between Lord Nuffield and the recently ennobled personage who presides over the Air Ministry.

THE next section of the Report is concerned with "taking the profit out of war", but this somewhat unfortunate caption does not adequately represent the views of the Commissioners, who state:

"The complete removal of the profit motive from private industry, which alone would satisfy the more ardent of those who feel moral objection to its continuance is, in our opinion, neither necessary nor desirable, and it is far from our purpose to propose that profits should be so restricted as to discourage private firms from undertaking the supply of arms. But it is our opinion that measures ought to be taken to restrict the profits of armament firms in peace time to a scale of reasonable remuneration."

Having laid down this premise they go on to say that they "do not propose to undertake the task of formulating specific methods," which is just as well, for it is not easy to see how this can be done by a democratic state without a violation of the principles upon which it is based. To do so would be to explore an avenue, if one may be excused the fashionable jargon of Geneva, that might well prove to lead to totalitarianism and Fascism.

Finally, there is the problem of the export of arms. The British system is that this can be done only under license by the Board of Trade, either specifically, or as being in a category the export of which is permitted under an open general license. In theory, this is granted unless reasons of state to the contrary are advanced by the Foreign Office or the Defense Departments. Of late years the tendency has been in the direction of restriction, and this is likely to operate to an even greater extent in the future as wars of political religion become the order of the day. When the Venizelist revolt broke out in Greece in March, 1935, the Greek Government was denied delivery even of the armaments it had ordered before the rebellion took place. The case of Spain during the past few months is better known. For some years to come it seems likely that all wars, whether civil or national, will arouse the most violent passions far beyond the countries immediately concerned, and such being the case, the difficulties which must face a third party supplying arms to the combatants are obvious. Another ALABAMA case might not, in the embittered condition of the modern world, prove capable of settlement by a cash payment. It is also important to note that aircraft do not come within the scope of the Foreign Enlistment Act, 1870, which forbids the enlistment of any British subject in the army or navy of any foreign state at war with a friendly nation.

The Commissioners propose to deal with this matter along the following lines:

"We are of opinion that the administration of the system of licensing exports of arms should be governed by an outlook different from and more positive in character than that which now prevails; that licenses should be granted only to such firms as shall have been specifically authorized to accept orders for export by the controlling body already recommended; that the grant of licenses should be restricted to orders by foreign governments, supported by import licenses issued by those governments which shall state that the goods will not be reëxported.

"We recommend that the practice of issuing open general licenses for the export of certain classes of arms, etc., be discontinued; that specific licenses be required in all cases; and in particular that a rigid control be exercised over all exports of aircraft, whether classified as military or civil."

As for the private export trade in surplus and second-hand arms and munitions, its complete cessation is recommended. This suggestion will doubtless be welcomed cordially by those British soldiers who, in various parts of the world, have been shot at by natives armed with second-hand rifles of British manufacture.

SUCH is the Royal Commission's Report, and it is to be welcomed for several reasons, of which not the least is the blow it has struck at ignorant sentimentality. Ever since the Armistice, public opinion in Great Britain has been under the influence of internationalist visionaries, and those who tried to put forward any other point of view were regarded as little better than criminals. Successive administrations, irrespective of party, pursued a pacifist policy, starved the Navy, Army, and Air Force, and trusted to the League of Nations to save them from the consequences of their own madness. The Peace Ballot, to which allusion has already been made, represented the peak of this folly: the National Government threw discretion to the winds and mobilized Geneva against Italy, only to find that the British people were not prepared to do anything more than make a rude gesture at Mussolini, while most other nations were not ready to go even so far as that. Since then, Ministers have been in full retreat, and have been subsisting on a meal of their own utterances during the past sixteen years, to the no small amusement of those who, like the present writer, never shared their illusions. Regarded from this angle, the Report represents another nail in the coffin of a false ideology, for in measured terms it rejects the theory that wars are made by wicked armament manufacturers.

If the Report materially helps to bury the past, it should do much to compel realization of the present and future. There is now a great deal of vague talk about the "next war," and in too many instances in England preparations are being made for it as if the enemy were Louis XIV or Napoleon. The corollary of the Royal Commission's Report is General Fuller's new book, "The First of the League Wars," in which the author discusses the technique of modern totalitarian warfare. Unless there is greater coördination between the authorities on the one hand and armament manufacturers on the other than there was prior to 1914, that "next war" will be lost. So far the Goverment has shown no disposition to take action on the Report, which does not provoke any astonishment in view of its partiality for the line of least resistance, but the document puts a weapon into the hands of those who are determined that, if war comes, Great Britain at least shall be as ready as any of her neighbors as far as armament goes.

The Thirty Years' Peace

An Interlude in the History of the United States Army

By Col. Oliver Lyman Spaulding, Jr.*

HEREWITH are excerpts from a chapter in the author's forthcoming volume "The United States Army in War and Peace," to be published March 1, 1937, by G. P. Putnam's Sons, New York. This will be a companion volume to "A History of the United States Navy," by Capt. Dudley Knox, U.S.N., which appeared in the Fall of 1936 and which was reviewed in the November-December issue of this journal.

ARMY ORDNANCE *is pleased to have this opportunity of presenting to its readers a foretaste of Colonel Spaulding's work. In these excerpts we have chosen pertinent paragraphs from the chapter entitled "The Thirty Years' Peace"—that period from 1815 to 1845, when, with the exception of the Indian wars, there was only the task of exploration, the construction of border forts, study, and "soldiering". The period is sometimes unjustly referred to as the Dark Age of our Army, but Colonel Spaulding, eminent military historian, has shed a bright light upon it. Having read the unpublished manuscript in its entirety we can vouch for the comprehensiveness, circumspection, and fascination of the author's classic work soon to be presented to the public in book form.*—EDITOR.

PEACE having been declared, the war-time army of course disappeared. The militia and volunteer corps were sent home at once, and the now regulars were not far behind. On March 3, 1815, only two weeks after news of the treaty reached Washington, Congress passed an act effective May 1st, fixing the peace strength at ten thousand men. Reduction had to be made everywhere, but especially in the infantry.

The country was organized for military purposes into two divisions, Northern and Southern, each under a major general and two brigadiers. The surplus general officers were discharged or reduced to the grade of colonel. The remaining generals, with the Secretary of War, drew up a plan for general reorganization. This was fairly simple for the staff departments, but for the troops it was complicated.

The infantry regiments were arranged, according to the location of their stations, in eight groups, four or five old regiments in each. The four rifle regiments were grouped by themselves. The remaining infantry regiments and the dragoons were grouped with artillery units. Then in each group a new regiment was formed, the surplus men being discharged. This gave the enlisted force for one regiment of light artillery, ten companies; eight battalions of artillery, four companies each; eight regiments of infantry and one of rifles, ten companies each.

From the officers at large, the proper number was selected to officer all the regiments. Each unit was now complete, but only the light artillery and the rifles possessed names.

For the artillery, each battalion was given a number in its own division, according to the territorial position of the fortifications which it was to occupy. For the infantry, the new numbering was based upon old English custom, and specifically upon Washington's orders for the Continental Army—that regiments were to take precedence among themselves according to the relative rank of their colonels when first organized, such regimental precedence not to be changed thereafter.

And this was done. The consolidated regiments received new numbers, bearing no relation to the old numbers of their component parts. That commanded by the senior colonel became the 1st Infantry, and so on. There were a few changes made in the scheme of consolidation first drafted, and there were a few controversies as to relative rank of officers, but in general the plan stood. There were doubtless jealousies and regrets at the time, when officers and men lost the old regimental numbers for which they had quickly acquired affection. There has been confusion from time to time since; as, for example, a generation ago, when the 21st Infantry, a new regiment raised during the Civil War, asked authority to assume the regimental motto earned by the old 21st at Lundy's Lane, and the War Department had to point out that this motto now belonged to the 5th, into which the old 21st had been consolidated. But in general the plan worked satisfactorily. The regimental numbers then assigned have stood as the basis for all subsequent reorganizations in the infantry.

THE law, it will be noted, made no provision for a commander for the entire Army. Each division commander's authority was limited to his own territory. An Adjutant and Inspector General was stationed in Washington, and issued orders in the name of the Secretary of War; but the Secretary, following the bad habit acquired by the War Department during the War of 1812, did not always send his orders through the regular channels. Communication was slow, and to save time and trouble they were often sent direct to the officers concerned. This always caused confusion, and sometimes danger. The matter became acute in 1817. General Jackson, in command of the Southern Division, learned from the New York papers of the arrival there of an officer who had been on special duty under him, who had been relieved and sent north without his knowledge. He at once sent a strong protest to the President, and when this was not answered promptly he issued general orders forbidding his officers to obey any order from the War Department which had not come through his headquarters. In the same order he directed all commanding officers to report the names of officers absent from duty, with the reasons for absence. The order ended with the words, "The

*Author: "Notes on Field Artillery," 1906. Coauthor (with Nickerson and Wright): "Warfare," 1925. Colonel, Field Artillery, U. S. Army.

Army is too small to tolerate idlers, and they will be dismissed the service." This sentence was probably intended to irritate the Secretary, for it was copied verbatim, without quotation marks, from a War Department order issued the year before in an effort to expedite the formation of the new regiments.

A conflict was not slow to arrive. General Ripley, in command at New Orleans, refused to obey a War Department order sent to him direct. Jackson assumed the responsibility, and offered himself for trial by court martial. But a new Secretary, Mr. Calhoun, had just taken office; he sustained Jackson, and directed that the old practice cease.

War, then, with Great Britain was at an end, and the Army had been placed on a peace footing. But this did not mean that the Army was to have peace.

II

THE Seminoles, or eastern branch of the Creek Indians, had been friendly to England during the war. When the last English garrison was withdrawn, the commanding officer left with them the strictest instructions to keep peace with the United States; but he left also, in his fort on the Appalachicola River, three thousand stand of arms and a large stock of powder. This fort soon came into the possession of a colony of renegade Indians and fugitive slaves from American territory, and became a center for depredations and disorder of all kinds. Moreover, it jeopardized supply by water of Fort Scott, on the Georgia-Florida border near the forks of the Appalachicola—one of a chain of posts which General Gaines, commanding in Georgia, was building. Protests to the Spanish governor were fruitless, and Lieutenant Colonel Clinch was sent down from Fort Scott with two companies of the 4th Infantry to destroy the "Negro Fort", as it was called. The Seminoles themselves resented the presence of this outlaw colony on their lands and sent a war party to coöperate with him. The magazine of the fort was blown up by a red-hot shot, destroying most of the garrison, and Clinch allowed the Indians to take the arms which remained.

But as construction of the border forts went on, the Seminoles grew restive, and General Gaines at Fort Scott found himself involved in hostilities with them. He could gain no decisive advantage, for raiding parties escaped across the Florida line into Spanish territory. Authority was finally granted from Washington to pursue across the boundary. This was justifiable, for Spain was bound by treaty to control her Indians.

Gaines called upon the Georgia militia, as he was authorized to do, and also, on his own responsibility, raised a force of nearly two thousand Creek Indians. These he organized into a brigade and appointed officers himself, from brigadier general down. Jackson, also exceeding his authority, raised two regiments of Tennessee Volunteers of five hundred men each, and with the first few companies started overland from Nashville to join Gaines. After a hard march of forty-six days he reached Fort Scott on March 9, 1818. The garrison consisted of the 4th and 7th United States Infantry—nine hundred men. With nine hundred Georgians and two hundred Tennesseeans—not to mention the Indian brigade—Jackson had two thousand men at the fort, and three days' short rations of corn and pork. Making this stock last five days, he marched down the river and met the supply boats coming up from New Orleans.

Active operations against the Seminoles were then opened. These led the expedition as far east as the Suwanee River, and incidentally involved the occupation of the small Spanish post of St. Marks and later of Pensacola, the capital of West Florida. The Spanish governor withdrew to Fort Barrancas, at the entrance of Pensacola Bay, and Jackson bombarded and captured the post.

THIS attack was certainly an act of war against Spain, and possibly the whole campaign might have been so treated had she chosen. But she was in no condition for defense, much less for offense, and made no move. Nevertheless, two wars existed, *de facto,* whether declared or not—one against the Indians and one against the province of West Florida, and Jackson claimed to exercise full war powers. This exercise came within a hair's breadth of causing still a third war, a war with Great Britain.

During the campaign, two British subjects, traders with the Indians, had been arrested—Alexander Arbuthnot and Robert Ambrister. These men were charged with encouraging the Indians to hostilities against the United States and furnishing them assistance. They were brought to trial at St. Marks before a "special court" of which General Gaines was president, were sentenced to death, and the sentence was executed.

This action, certainly high-handed whether or not justified, caused great excitement both in Washington and in London. At last, however, Jackson was sustained, and an explanation drafted which satisfied Great Britain. The Spanish posts were returned, but soon afterward all Florida was ceded to the United States.

Again the Army had nothing to do but garrison duty, mostly on the frontiers in small posts. Its ten thousand men, more or less, were distributed along a circle of about four thousand miles in circumference—from Mackinac and Detroit along the Canadian border, the seacoast and the Mississippi River to St. Louis. Still, there was no longer a war, and in 1820 Congress called upon the Secretary to report upon a plan for reduction of the Army to about six thousand.

As noted above, Mr. Calhoun was now Secretary of War, and had already shown energy and originality in the management of his Department. On December 12, 1820, he submitted the report required.

This report is a somewhat remarkable document, well ahead of its times. It suggested several innovations which, although not all adopted at that time, deserve mention.

FOR artillery, changes in equipment and tactics often cause changes in views as to organization. Sometimes it seems best to separate organically the functions of field and fortress troops; at other times, to combine them. At this time, the tendency was toward unification. As for strength, the regiment of light artillery, ten companies, gave too heavy a proportion of guns for the small infantry force. At the same time, there was demand for more than the existing thirty-two companies of foot artillery to man the guns in the forts. Mr. Calhoun proposed, therefore, to break up the regiment of light artillery, which was light in name only, for the companies were not mounted; to raise three new companies, and then, with the forty-five companies, to form five regiments, each of which should have eight foot companies and one light battery, officers to receive training in both forms of service. The required reduction in strength he wished to make by reduction in the strength of each company rather than by

reduction in number of companies. The total artillery strength would be about three thousand rank and file.

A similar plan was proposed for the infantry and rifle regiments. The number of regiments was to remain the same, but company strength to be reduced so as to cut the total to about thirty-three hundred rank and file. This was based upon companies of four squads, or thirty-two rank and file, considered as the minimum for instruction purposes. The regiment would form its eight battalion companies in a single battalion, the two flank companies (both light, for grenadiers had never found favor in this country) would be grouped provisionally, as required, into light battalions—the system with which we are already familiar in the colonial and Revolutionary wars.

Evidently, this organization was intended for instruction and garrison purposes only; it would not be economical for service, for no officer had an adequate command. Hence a war strength was proposed, about double the peace strength, making each battalion as large as was considered maneuverable. This increase would be in privates only, no additional officers or noncommissioned officers being required. The artillery would expand itself in like manner, although not quite to the same extent, and the total war strength would be upward of ten thousand men—that is, fully as great as under the 1815 organization.

These proposals were adopted only in part at the time, but have all been tried since, in principle, in our service. Mr. Calhoun suggested also one other idea which seems to have great merit; it has been applied occasionally and partially in special cases but has never yet been worked out and applied systematically.

FOR the infantry he suggested a further step. Having raised his battalion to war strength, he proposed to split each company into two companies, and form his regiment in two battalions, doubling the number of officers and noncommissioned officers and again raising his companies to war strength by adding recruits. The battalions would then be commanded by lieutenant colonels, after the English fashion, and the colonel would continue to exercise command of the enlarged regiment, handling it like a small brigade. This plan appears to be perfectly sound in principle, but to carry it out in practice would require some form of training schools to provide the new officers and a regimental depot to bring in and train the recruits—an actual reserve roll, controlled by the regiment and active both in peace and war. Not until very recently have we been in a position to set up this machinery, and we have done so only in part even yet, and so this plan has never been made the basis of our mobilization system.

But while it might well be tried now, the idea stood no chance whatever then. Congress had in mind economy only, and was not interested in mobilization plans. Hence it discarded all idea of expansibility, and effected its economies chiefly by reduction in the number of regiments.

By the act of March 2, 1821, the artillery of the Army was organized into four regiments, each with eight foot companies and one light battery. The 8th Infantry and the rifle regiment were disbanded, leaving seven regiments of foot. The number of general officers was reduced to one major general and two brigadiers. Major General Brown was assigned to station in Washington, as general in chief. A new territorial organization was announced—an Eastern and a Western Department, the boundary being a line from the southern point of Florida to the northwestern tip of Lake Superior. Brigadier General Scott was assigned to command in the east, with headquarters at Governor's Island, New York; Brigadier General Gaines in the west, with headquarters at Louisville, Kentucky.

Although the troop strength had been reduced, the frontier line to be held had been extended. The Army had pushed out from Detroit and Mackinac and had established Forts Dearborn and Howard at Chicago and Green Bay; at the same time it had pushed up the Mississippi from St. Louis to Forts Armstrong at Rock Island, Crawford at Prairie du Chien, and Snelling at the Falls of St. Anthony where Minneapolis now stands. Up the Missouri it had gone as far as Fort Atkinson at Council Bluffs; up the Arkansas to Fort Gibson at Muskogee; and up the Red River to Fort Towson fifty miles west of the Arkansas-Oklahoma line. In general, the artillery held the posts from Mackinac along the Canadian border and the seacoast to New Orleans; the infantry the western frontier from Pensacola to Fort Snelling and Green Bay. These western stations were, for the most part, just beyond where the roads ended and the wilderness began; as late as 1827 the postoffice address of Fort Snelling was still St. Louis.

FOR the foot artillery, however, a step was taken almost immediately which has been of the highest consequence, not only in that arm but in the Army at large. In April, 1824, orders were issued for the establishment of an Artillery School of Practice at Fortress Monroe, Va. Ten companies of artillery, representing all four regiments, were assembled there. By detail from these batteries and from the artillery at large, an administrative and instructional staff was formed, including departments of mathematics, engineering, drawing, and chemistry. Cadets assigned to the artillery upon graduation from the Military Academy were sent here for a year's training before joining their regiments.

This was the first of our Army graduate schools. Except for brief periods of emergency, as during the Civil War, it has had continuous existence, and has served, through many reorganizations, as the inspiration and model for similar special schools in all the various arms, in many of the technical and administrative staff services, and for the higher general service schools.

The western expansion evidenced by the establishment of the new frontier posts was marked by Indian troubles, and from time to time these became serious enough to bring out troops. In most cases local militia or volunteers sufficed, but the greater ones required action by the Federal Government. The first of these greater emergencies, after Jackson's Seminole campaign, was in a new direction—to the northwest.

III

DURING all this period, in spite of the constant heavy field duty and the scattering of the troops, study and instruction went on, and the Army kept up its efforts for technical and professional improvement. No matter how small and isolated the post, every garrison had its regular parades and drills, with as much precision as if the world were there to see. As for instruction in field service, this generally took care of itself. The Indian wars with names and dates, such as those described above, represented but a fraction of the occasions when the troops had to act to protect the settlers. These obscure little operations were all taken as a part of the day's

work; as soon as the curt official report had gone in, everyone forgot about them and turned his eyes forward, on the alert for the next alarm.

Textbooks, although not too plentiful, had been published occasionally even from the time of the Revolutionary War. These were generally infantry drill manuals, but a drill manual came nearer to being a complete military textbook then than it would be now, and more pretentious works were not unknown. Col. William L. Duane's "Military Library" (2 vol., Philadelphia, 1809) was a comprehensive treatise on the art of war, and Col. Louis de Tousard's "Artillerist's Companion," published in the same year, was a similarly encyclopædic work on that arm, by a French officer who had served in the American artillery.

In infantry, our manuals followed generally the English models, but in artillery we tended to the French—for, as we have noted above, we had, during the Revolution, made efforts to secure foreign technical specialists even when we had to decline the services tendered by adventurers and soldiers of fortune. The new French Gribeauval artillery—an improved, lightened and standardized system—had its first service test in the Yorktown campaign, and shortly before the War of 1812 we had adopted that system. This further encouraged the study of French methods; during that war we depended chiefly upon Tousard, and upon an adaptation, by Maj. Amos Stoddard of our artillery, of a manual prepared in 1800 by General Kosciusko. After that war, the experience of the Napoleonic wars was embodied for us in a "Treatise on Artillery" by General Lallemand, one of Napoleon's artillery officers who took refuge in this country after Waterloo.

Winfield Scott, from the very beginning of his service, had urged the necessity of regulations and tactical manuals. It will be remembered that he had had difficulty in finding suitable elementary texts when he undertook the instruction of the new troops in 1814. With this experience in mind, no doubt, after the war he began to write and to encourage other officers to write. He was president of several boards appointed for such work, and he himself had a large personal share in the preparation of both drill books and general regulations. He encouraged also the study and translation of foreign books: it will be remembered that a French manual had served as the basis of his 1814 training.

THE need of instruction books was especially acute in the field artillery. Although, under the law of 1821, each artillery regiment was supposed to have a light battery, none of these batteries was actually mounted until 1838, and in such instruction as was given, the carriages were moved by men. To keep the tradition alive at all, books were needed. Lieut. Daniel Tyler, 1st Artillery (the General Tyler of the Civil War), while a student in the Artillery School at Fortress Monroe, made a translation of regulations of the French Garde Royale, which was officially adopted and published. This manual proved so valuable that Tyler was sent to France to make a complete study of the Gribeauval system of matériel, organization, and tactics. He was admitted to the Artillery School of Practice at Metz, remained there for a year, and made an elaborate report on the whole system, including translations of the regulations. These regulations dealt with all classes of artillery, from field to seacoast; a small lithographed edition of the translation, in three volumes, was published at Metz under Tyler's own direction.

But his report showed that these regulations were already obsolescent. England had been developing entirely new designs for field guns and carriages, bringing them to the same general type familiar to us from Civil War trophies. These were much handier in maneuver, both on roads and across country, and much easier to serve in action. The French had been experimenting with these new guns, and had just decided to adopt them. Tyler observed several of the new batteries in use, and saw at once their superiority to the Gribeauval system; on his own initiative and at his own expense he secured complete drawings and specifications of them. After careful study, the new system was adopted in 1836.

This development was most timely, for in 1838 the War Department began to give effect to the authority in the act of 1821, and to mount the light batteries of the artillery regiments. The first to receive the new equipment was Capt. Samuel Ringgold's Battery "C", 3rd Artillery, now Battery "E", 1st Field Artillery.

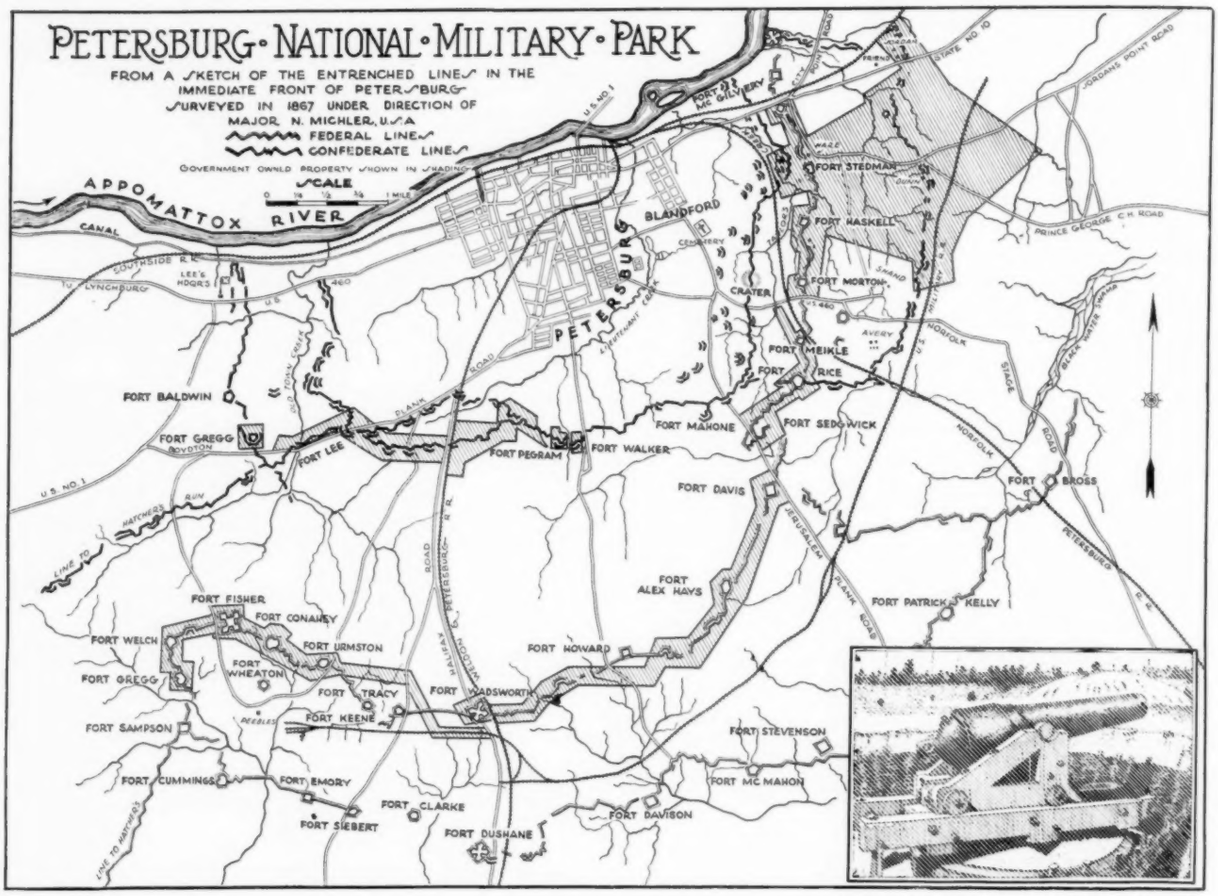
New drill regulations were of course needed, and Lieut. Robert Anderson, 3rd Artillery (whom we shall meet again at Fort Sumter in 1861), translated the French "Instructions for Field Artillery." Meanwhile Captain Ringgold had begun the training of his new battery with the English Drill Regulations, and the regulations finally adopted were a compromise between the two. The new matériel and drill regulations, then, although adopted by us from the French, were fundamentally and essentially English. In France the system was known as the *système anglais modifié*.

ONE more activity of the Army during these years remains to be considered. The essential characteristic of the period was western expansion and emigration, and in all this the Army played its full part. Not only did it maintain the outpost line and provide bases for commercial and emigrant trains, but it had its share in the reconnaissance and patrol of the routes.

All the great transcontinental trails started from the region of Kansas City, and the route was up the Missouri and Platte rivers to the forks of the Platte in western Nebraska. Here the trail also forked, and the old Santa Fe Trail led up the South Platte to the region of Denver, thence south along the eastern foot of the Front Range to Santa Fe. This was of course a roundabout road, and after Lieutenant Pike's explorations of 1806 the shorter routes by way of the Arkansas Valley were used. From Santa Fe, extensions of the trail ran to the Pacific—the Spanish Trail through southern Utah to Los Angeles, the Gila Trail up the Gila River to San Diego.

The other great branch of the road, the Oregon Trail, led past Fort Laramie up the North Platte and Sweetwater rivers, under the shadow of the Big Horn Mountains and across South Pass by easy grades to the Green River and Fort Bridger; thence to Fort Hall at Pocatello, on the Snake River, downstream past Fort Boise to Fort Walla Walla, and down the Columbia to the seacoast. At Fort Hall a branch, the California Trail, crossed Nevada to Sutter's Fort and the Sacramento River.

And so, with Indians south and west; with filibusters on the Mexican and Canadian borders; with explorers, traders and emigrants; with the construction of numberless posts by troop labor; with training and instruction in all the intervals of other things—with all this, we see that the Thirty Years' Peace was a busy thirty years for the little American Army.



National Park Service, U. S. Dept. of Interior

LIST OF ARTILLERY USED IN THE SIEGE OF PETERSBURG

FEDERAL

Siege, Army of the Potomac:

No. of Guns	*Type*
38	30-pounder Parrotts, siege
36	Coehorn mortars
20	8-inch siege mortars
14	4½-inch siege rifles
12	8-inch siege howitzers
11	12-pounders, field
10	10-inch siege mortars
10	100-pounder Parrotts, rifled
9	20-pounder Parrotts, rifled
8	12-pounder field howitzers
6	10-inch seacoast mortars
4	10-pounder Parrotts, rifled
4	3-inch ordnance, rifled
2	32-pounder howitzers
1	24-pounder howitzer
1	6-pounder Sawyer, rifled
1	13-inch seacoast mortar
1	30-pounder, rifled (Brooke, captured from the Confederates)

Field Artillery, Army of the Potomac:

No. of Guns	*Type*
60	12-pounders, light
52	3-inch guns
12	Coehorn mortars

Special name or description:

No. of Guns	*Type*	*Location*
12	Napoleons	Artillery Reserve
1	8-inch Columbiad	
1	100-pounder Parrott on Dahlgren carriage	Bermuda Hundred
1	100-pounder Parrott on siege carriage	Bermuda Hundred
1	5.8-inch Sawyer gun	Battery Sawyer, Bermuda Hundred
	24-pounder Coehorns	Ft. McGilvery and Battery 12
1	3.8-inch Sawyer	
1	3-inch Parrott	
4	10-inch guns	Ft. Morton

CONFEDERATE

Captured April 2, 1865, Petersburg and Bermuda Hundred lines:

No. of Guns	*Type*
18	24-pounder Coehorns (iron smooth bore)
9	8-inch siege mortars (smooth bore)
7	12-pounders, light, brass (J. R. A. maker)
6	3-inch rifles
5	6-pounder iron guns (smooth bore)
4	12-pounder Coehorns (iron smooth bore)
4	30-pounder Parrotts (smooth bore)
3	12-pounders, light, brass (U. S.)
3	24-pounder howitzers (U. S.)
3	3-inch rifled (T. T. S. L. maker)
2	8-inch siege mortars (smooth bore)
2	8-inch howitzers, siege (smooth bore)
2	12-pounders (iron smooth bore)
2	12-pounder mountain howitzers (smooth bore)
2	24-pounder mountain howitzers (smooth bore)
2	32-pounder guns (short; smooth bore)
2	32-pounders (banded and rifled)
2	8-inch Columbiads
2	12-pounders, (iron; J. R. A. maker)
1	3.67-inch Blakely (rifled)
1	3-inch Blakely
1	20-pounder Parrott (rifled)
1	30-pounder Parrott (rifled)
1	10-pounder Parrott (J. R. A. maker)
1	30-pounder Brooke (rifled)
1	4.64-inch Brooke gun
1	4.5-inch Navy gun
1	12-pounder rifled (made in Richmond)
1	32-pounder Navy gun (smooth bore)
	Whitworth guns

An Ordnance National Park

Petersburg Earthworks to Mount Civil War Cannon Once More

IT is a far cry from the 30-pound Parrott rifles which poked their black muzzles at doomed Petersburg from behind Grant's earthworks back in those trying days of '65, to the gigantic, highly mechanized railway coast-defense guns of today which can hurl their 1500-pound projectiles for over twenty miles. Many of those old weapons which spoke so authoritatively in defense of the Union and so determinedly in defense of the Confederacy have long since become victims of the scrap heap while others rust away in country farmyards or on village greens unnoticed, their historical significance forgotten—almost forgotten, but not quite.

The Army Ordnance Association, although chiefly interested in the modern successors of these historic pieces and in other present-day implements of defense, still remembers the debt the present owes to the past, particularly in ordnance design and construction, and, after some deliberation and planning, has taken active steps to save these old war relics for posterity. Having secured the coöperation of the U.S. National Park Service, the Association has formed a committee of its members to assist in locating any artillery pieces of the Civil War period, and in having them permanently emplaced in the Petersburg National Park at Petersburg, Va.

The committee organized for this purpose consists of the following officers and members of the Army Ordnance Association: Brig. Gen. Benedict Crowell, president of the Army Ordnance Association; Brig. Gen. John Ross Delafield, Ord. Res., Association counsel; Lieut. Col. LeRoy Hodges, Ordnance Officer, Virginia National Guard; Lieut. Col. Calvin Goddard, originator of forensic ballistics; Mr. Stephen V. Grancsay, Curator of Arms, Metropolitan Museum of Art; Mr. F. W. Foster Gleason, research student in the ordnance of the Confederacy; Mr. Claud E. Fuller, writer on and collector of historic arms; and Maj. L. A. Codd, executive secretary of the Association.

The following officials of the National Park Service will serve in an advisory capacity: Dr. Arno B. Cammerer, director, National Park Service; Dr. J. Walter Coleman, superintendent, Petersburg National Military Park; and Mr. Branch Spalding, acting assistant director, Branch of Historic Sites and Buildings, National Park Service.

The principal function of this committee will be to obtain information as to the present location of any ordnance equipment of the types used at Petersburg. It will endeavor to authenticate any material reported to it and will assist in making arrangements for the transfer of such material to the Petersburg National Park for permanent display. Neither the committee nor the National Park Service is in a position to purchase any of this equipment, but it is hoped that ready and willing donors can be found who will present or transfer any desired pieces in the interest of historical accuracy.

The Petersburg National Military Park was established by Act of Congress, July 3, 1926, to commemorate the military operations around Petersburg during 1864-1865. In 1864, Grant, having failed to crush the Army of Northern Virginia at Cold Harbor, moved on Petersburg in an attempt to cut Lee's lines of communication and either envelop his army or force him to abandon Richmond. Having crossed the James the night before, Grant, on June 15, 1864, attempted to carry Petersburg by assault. The fighting lasted four days but only succeeded in driving the Confederates into entrenchments from the Appomattox to the Jerusalem Plank Road.

By August 25th, despite opposition by A. P. Hill's Corps, Grant succeeded in taking the Weldon Railroad and built Fort Wadsworth. Continuing the encircling movement, the Union Army extended its left beyond Peeble's Farm and built Forts Fisher and Welch. On October 27th, the Second, Fifth, and Ninth Corps attempted to establish the line to Hatcher's Run at the Boydton Turnpike. Mahone frustrated the effort by repeating his feat of getting between two Federal Corps, but by February 5, 1865, the line was finally established by the Second and Fifth Corps acting in coöperation with Gregg's Cavalry.

Lee's position was now extremely perilous. Fired with the courage of desperation, Gordon's Corps broke through the Federal cordon at Fort Stedman on March 25th in an effort to cut off Grant's right wing. The attempt failed, however, due chiefly to Hartranft's prompt action in sending reënforcements and to the absence of anticipated Confederate support.

Then followed the crushing of Lee's right wing at Five Forks by Warren and Sheridan on April 1st, cutting the Confederate lines of supply and forcing the evacuation of Petersburg and Richmond the next day. Harried and attacked at every turn, Lee retreated toward Lynchburg, but he never reached his destination. The gaunt men in gray were brought to bay for the last time, and the surrender at Appomattox on April 9, ended the War between the States.

The number and type of guns known to have been used at the seige of Petersburg are listed on the preceding page. It is possible, however, that other types of ordnance were used which are neither included in this list nor recorded in any official documents. Thus it will be the purpose of the committee not only to locate the types of guns actually used at Petersburg but also to find specimens of all the types of ordnance used throughout the entire war. Naturally, a committee of limited membership cannot possibly examine all the records, personally visit every locality where Civil War ordnance is likely to be found, or contact every patriotic and historical society. Great service in these respects can be rendered by anyone who has information as to the location of any of these old pieces communicating with the Secretary, Army Ordnance Committee, 806 Mills Building, Washington, D. C. In reading, in conversation, or in travel, one may chance upon a clue, which, if properly followed up, may lead to the "discovery" of one or more of these guns and add a further contribution to American military history.

The Association, in undertaking this task, has started at Petersburg the creation of what will constitute the only complete museum of Civil War ordnance in the United States, where even the novice may see at a glance the conditions of seige warfare in the sixties and the types of arms then used for offense and defense. It is appropriate that the Association, whose motivating principle is furtherance of the national defense of the United States, should thus commemorate these weapons and the campaign that kept these States united.

German Small Arms and Ammunition

Current Trends in Design and Development

By Calvin H. Goddard*

IN the course of five weeks spent in Germany during the summer of 1936, I visited a number of factories producing small arms and small-arms ammunition. My principal objective was the acquisition of data on cartridge headstamping which would serve later to identify such specimens of German manufacture as might come to hand. Secondarily, I hoped that perhaps I might see and learn something of German production methods. With respect to my primary aim, I was quite successful, sketching over 200 basic and subvarieties of headstampings which I hope to incorporate soon in a small volume on the identification of foreign-made ammunition. As to the second, I never managed to get further than the director's office.

FIG. 1. THE .22 LONG-RIFLE CARTRIDGE

Top: Standard rim-fire. *Bottom:* Special central-fire for "insert" barrels.

Yet to penetrate even that far was a real achievement. For in Germany everything in the arms industry appears to be *ganz geheim* (extremely secret). And had I not, in every instance, been very properly introduced (and usually accompanied by a high police official) I should have yet to pass the outermost portal of any of the plants toward which I bent my steps.

The routine admission procedure, which, subject of course to some variation, obtained in all factories visited, was as follows: A card recording your name and occupation, the firm you represent, if any, whom you wish to see and why, is filled out in the porter's office, just within the entrance gate. Your presence and purported mission are then announced by telephone to a High Command, somewhere within the deeper recesses of the plant. Word comes that you are to be admitted. The hour and minute are noted upon your card, which is intrusted to a guide. He leads you through devious passages to a waiting room, seats you, and departs. A period of five to ten minutes elapses. The escort returns, and conducts you to a second chamber, somewhat more elaborately furnished. Again he bows you to a seat, and vanishes. You feel that the first phases of your passage through Purgatory have been accomplished safely.

Suddenly an inconspicuous side door opens, and an official enters—perhaps the one you asked to see, perhaps another. He has your descriptive card in hand, and asks, somewhat abruptly but not ungraciously, what he can do for you. (You are at once certain that he has been scrutinizing you through a secret panel ever since you arrived, and try to recall what incriminating gestures you may have made meanwhile.)

You explain that you are just an humble American trying to get along in the world and accumulate an odd crumb or two of information about the manufacture (*strictly nonmilitary*) of small arms and ammunition in Germany. That your work at home is such that the more familiarity you have with such activities the world over, the better you will be able to undertake your varied tasks. And you outline in detail your objectives.

The official then proceeds to answer in reasonably full measure your inquiries as to headstampings, components, and whatnot, if you happen to be in an ammunition factory, or metals, rifling processes, etc., if he is making small arms. He also evinces much interest in what *you* have to tell of corresponding American practices. At last, having acquired some or all of the statistical data desired, you broach the vital question—could you, perchance, actually *see* some ammunition in the making, or a barrel in the rifling?

His reaction is either to pretend that he has not understood your very indifferent German and thus give you a chance to allow your request to die gracefully, as though never made, or to explain carefully that company rules never permit visits to the factory proper and that much to his regret, it will be impossible to make an exception in your case. Either way, you don't get in.

The conversation falters to an end. You are voluble in your expressions of appreciation, and bow yourself clumsily out of the presence of Mr. Official, who has meantime entered upon your interview card the hour and minute of your departure from his office. Breathlessly you rush back to the porter's blockhouse to relinquish your credentials ere an undue interval of time elapses. You gasp with relief when the exit gate swings open, and you emerge into the outer air—still a free man.

BUT when your visit is to a plant producing *military* munitions, it is something else again. First of all, cameras are banned, though of what use it would be to take photographs of those areas to which one is given access, I cannot see. Secondly, you must be *unusually* well identified. I recall one factory which makes ammunition for the German infantry rifle (model '98) and the service pistol (model '08). My official guide (from another city) had unfortunately forgotten the name of the particular individual we were to see. Ten minutes, and a dozen telephone calls to persons within the plant—not to speak of one to local police headquarters—were required before we gained admission.

Obviously, I made no inquiries as to *current* production. But I did want information on pistol ammunition in the conventional 6.35- and 7.65-mm. calibers which the firm had formerly made. Yet so obsessed was the gentleman with whom we talked of the necessity for secrecy, that it was with difficulty that I elicited the bare admission that perhaps they *had* produced something of the sort (6.35 and 7.65) in years gone by! Indeed, this functionary seemed to be in a blue funk throughout the course of our brief interview and was immensely relieved when it came to an end.

All of which may convey the impression that my sojourn in Germany was unproductive insofar as any worthwhile observations upon present trends in its small arms and ammunition industry are concerned. But this is far from the case.

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FIG. 2. TYPES OF GERMAN GAS AND BLANK-CARTRIDGE PISTOLS AND REVOLVERS

Indeed, I chanced upon many things which proved most informative. Probably none of these will be news to our military or civilian technicians, but some, at least, should be worth recounting for the benefit of the average American interested in small arms and in timely developments in this field. In this regard I believe the following observations are worthy of record.

The development of a new (short) shot shell of aluminum, while a relatively old story in Belgium, and possibly in France as well, is a recent one in Germany. It is of especial significance to American shooters in that a license for production in the U. S. has already been secured by one of our own manufacturers and is soon to be exploited, according to the information given me. Among the obvious advantages of such a shell are its decreased length (54 mm., or about 2.16 inches in 12 gauge) and weight—reduction in the latter being due to elimination of base wadding, the shorter case made possible as a result of this, and the substitution of aluminum for brass. This means that more rounds can be carried in less space and with less fatigue. As to what patterns such loads give when fired from standard American arms with their materially longer chambers, I gained no information, but the assumption is that they perform satisfactorily. A second question—how they would handle in the carriers of repeating shotguns designed for the longer shells—also remains unanswered, but I fancy that the problem is by no means insurmountable. One possible advantage of the shortened case is that it permits the design of new repeating and automatic weapons with shorter breechblock travel and hence shorter, lighter frames.

The replacement of paper and brass with aluminum in shot-shell construction after the former materials have ruled for lo, these many years, appears to me a matter of considerable significance. For while the latter has not yet been shown to be commercially adaptable for employment in the manufacture of cases designed for loads developing higher pressures, the possibility that some alloy of it may yet prove satisfactory for this purpose, is a pregnant one. And while the problem of increased cost promptly enters, we have but to recall that aluminum, when first produced, was about worth its weight in gold, and that further material reductions in the cost of its newer alloys are not without the bounds of possibility.

WITH respect to shoulder arms, the Meffert firm of Suhl has pioneered with considerable success in the use of duralumin in the frames and actions of rifles and shotguns. This firm builds many types of rifles and shotguns, and combinations of these, with frames of duralumin, at a saving of 300 to 500 grams in weight over corresponding arms with all-steel components and at an increased expense of but ten to twelve dollars per weapon—not much in a high-grade piece. Mr. Meffert, who showed me some of his products, informed me that they had yet to have a frame fail in the proof tests, whereas the steel barrels occasionally succumb. I later learned from Mr. Robert Churchill, the famous gunmaker in London, that the German firm of Merkel uses duralumin in its barrels. However it was then too late for me to secure data on this company's products.

Be it explained that all of Meffert's arms are built upon the

break-open principle exemplified in the conventional construction of our double-barreled shotguns, and I did not gather that any duralumin frames for high-power *repeating* rifles had been commercially attempted. But the innovation is an interesting one, and its possibilities appear to be far from fully exploited.

FIG. 3. CAMOUFLAGED BLANK-CARTRIDGE AND GAS GUNS
Left: 12-gauge, two-shot gas gun. *Center:* Cal. .320 blank-cartridge pistol. *Right:* Cal. .320 two-shot blank-cartridge pistol.

It is worthy of note that duralumin takes a handsome dull blue-black finish, indistinguishable from that applied by many makers to steel. It machines more easily than steel, and mechanics find it a pleasant metal with which to work.

Turning to handguns, Walther of Zella-Mehlis, and Menz of Suhl have long offered a choice of duralumin or steel in their automatic-pistol frames, at no extra cost for the former, which is put out in a dull grey-white (aluminum) finish, not particularly pleasing to the eye, in my opinion. They are available in blue-black finish as well, however. But since these arms are relatively light pieces anyway, I see no advantage, but rather the opposite, in fitting them with duralumin frames, apart from the single virtue of these being rust-proof in the sense of freedom from the development of *iron* oxides.

The very logical production of a .22 long-rifle cartridge with *central* priming for use in *Einsteckläufe* (insert barrels of small bore for subcaliber practice), in central-fire automatic pistols and rifles of caliber 7.65 mm. and above. The cartridge, looking for all the world like a standard rim-fire .22 long-rifle, with copper case and lead bullet, differs from this in external appearance only in that it exhibits an annular indentation or crimp which encircles the case a short distance above its head (Fig. 1). Its purpose is obviously to hold in position the inside primer which is introduced from the shell mouth and seated just above the head rather than in an aperture within it, as in the conventional center-fire types. It is thus not greatly unlike our .50-70 and .45-70 Springfield cartridges of early vintage.

The development of this ammunition makes possible the uninterrupted use, in the many central-fire arms for which reduced-caliber barrels are available in Germany, of standard firing pins and breechblocks in place of such subterfuges as special breechblock assemblies, inside barrels eccentrically bored, etc., which are necessary when ordinary rim-fire cartridges are employed. The idea appears to have much merit, and be worthy of adoption in American circles. Of course the ammunition is more expensive than its rim-fire counterpart, but not sufficiently so to put it beyond the reach of the average shooter, and of course it is infinitely cheaper than standard-caliber ammunition for the various arms to which it is adapted.

THERE is an increase in the manufacture and use of *Schreckschusspistolen* and *Betäubungspistolen*—weapons to frighten, deafen, daze, or temporarily blind an assailant. The German Government, though permitting no unlicensed carrying of concealed weapons, wisely recognizes the fact that blank-cartridge pieces so constructed as to be incapable of use with ball ammunition, are not deadly—save perhaps occasionally to their users—and that they may readily, by their very appearance alone, or combined with the smoke and flame of a blank discharge, frighten off a would-be assailant. It holds the same attitude toward gas weapons. As a result, a large portion of the populace has availed itself of these instruments of self-protection, and more and more varieties are constantly being produced in every conceivable form, from crude-appearing single-shot pistols, to revolvers and automatics which simulate exactly the "real thing" (Fig. 2).

The fact that such "arms" have a defensive value only is conceded by the authorities, for no one but a madman would attempt a real holdup with one. (And the German regulations are about as tough as they come, in the matter of controlling traffic in deadly weapons.) In which sensible attitude the Government of the Third Reich puts to shame such legislative groups as congregate in the halls of many of our state capitols to enact laws making it a felony to carry a gas pistol! Over there they do things more simply. They make murder a capital offense and *mean* it, and he who commits murder is caught (most certainly) and decapitated (very expeditiously). No laws with regard to gas guns are necessary, for murderers don't use them. Of course, there as here, the hardened criminal disregards those laws bearing upon

FIG. 4. CAL. .22 RIFLE AND TWO AIR GUNS
Top: Cal. .22 rim-fire rifle. *Center:* Air rifle with compression lever concealed in forestock. *Bottom:* Air rifle with bolt-actuated compression lever.

really deadly instruments, but he doesn't last a long while.

Some of the blank-cartridge and gas pistols which the Germans are producing are ingeniously camouflaged (Fig. 3). The conventional pen and pencil types are, of course, numerous. But a "pen" shooting .32 C. F. blanks out of *both* ends was to me an oddity, as was a "key" gun (made in simulation of a key) firing the same ammunition. The "double-header" "pen" just described is also made in larger sizes up to and including a 12-gauge affair, for gas, which must pack considerable bad news within its cavernous depths.

Revolvers up to 12 mm. in caliber for gas shells are not uncommon, and in the larger forms have a fearsome appearance because of the huge frames and long cylinders which they embody. One glance into the muzzle of such an arm should be sufficient to discourage any but the most intrepid footpad.

Owing to a woeful lack of both indoor and outdoor facilities for small-bore target shooting in Germany, caliber .22 rifles are much less common there than in the United States. Another reason for their paucity is that they have to be registered under the firearms act, and most people won't bother with the red tape attendant upon this. Besides, they cost, at the least, a few dollars, and at the most, a great many, and very few Germans have either few or many dollars to spend on luxuries. Again, the land is not "open" as it is with us, and the owner of a .22, if lacking his own acres or those of a friend over which to ramble, leaves his gun at home if he doesn't want trouble. The result is that air guns of every conceivable description largely take their place. These are produced both as pistols and rifles and in countless single-shot and repeating forms. In the case of the shoulder arms, every attempt is made to construct some of these on lines indistinguishable from those of a full-sized caliber .22 single-shot or repeating bolt-action target arm. How well this has been accomplished is illustrated in Fig. 4, which shows a .22 R. F. rifle contrasted with two air weapons. These pieces, when rifled, as all the more expensive ones are, possess considerable accuracy and sufficient energy to relieve an unwary sparrow of his earthly cares. Being practically harmless to humans, they can, of course, be used with relative safety both indoors and outdoors in districts where a .22 would constitute a real hazard.

Among the caliber .22 weapons, apart from the trick hammerless single-shot pistols with double-set triggers, fancy sights, fearful and wonderful grips, etc., which are the abomination of some Americans and the consummation of all hope and desire to others, certain examples are interesting. These include the Walther .22 rifle which can be used at will as an automatic, repeater, or single shot, and the .22 "P. P." model automatic pistol by the same firm, which is to all intents a

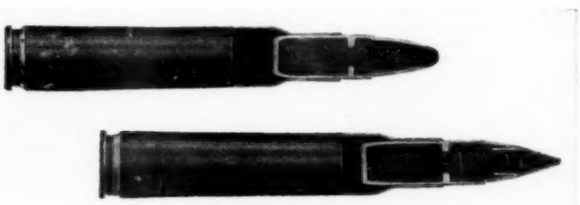


FIG. 5. CARTRIDGES LOADED WITH "H" BULLETS

counterpart of its larger brothers in calibers 7.65 and 9 mm., thus constituting an excellent practice arm for those who carry the larger weapons as regular equipment. Fitted with the double-action cocking feature for which this model is renowned, the gun when loaded is quite safe, the firing pin being disconnected from the hammer until the trigger is

FIG. 6. EFFECT OF "H" BULLET ON GAME

Nose well fragmented; base intact insuring good penetration.

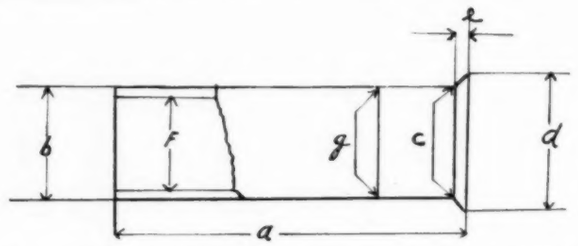
pulled double action when the safety ceases to function and a cartridge is discharged—the piece standing ready to operate automatically thereafter. Menz, of Suhl, produces a very similar arm, but here two pulls on the trigger are necessary to discharge the initial shot. Of these the first cocks the weapon and the second fires it.

AGAIN Germany's lack of ready cash for luxuries has set her to devising really cheap but accurate types of ammunition for indoor practice in various hand and shoulder weapons of calibers above .22. Such ammunition is known as *Uebungsmunition, i.e.,* ammunition adapted to subcaliber barrels of very small bore. The commonest of these types is the 4-mm. center-fire ball cartridge projected by a charge of priming mixture only, as in our "BB Cap." These, fired from "insert" barrels (*Einsteckläufe*) are adapted to many types of automatic pistols and also to single-shot and repeating rifles. They are fed into the chamber either by means of a "loading spoon" or the use of dummy cartridges of full caliber, each bored from end to end to receive one of the tiny 4-mm. slugs. Up to ten yards they are extremely accurate, and cheap enough to produce little strain upon even a slender pocketbook.

Not a single item of small-arms progress which I could mention as obtaining in America but that the Germans had already tried one, two, or three decades earlier, and usually discarded for something as yet unknown to us. The Old World is wise in its generation, and the New might well scan its ledgers before embarking on costly experiments in uncharted fields. It will usually find complete accounts of similar undertakings already recorded in the foreign literature and save itself time and effort by giving these serious study before launching upon its own programs.

There is evident in Germany an increasing tendency to get away from steel bullet jackets. Study of the current ammunition catalogs shows numerous instances of the employment of gilding metal or other nonferrous alloys where steel was formerly supreme. This trend has already gone so far with respect to pistol ammunition that few if any of the standard loads now embody steel-clad projectiles.

The "H" bullet (clad with a jacket which resembles the letter "H" in longitudinal section) for sporting purposes in high-power rifles, announced only a year or two ago (Fig. 5), seems to be going over in great shape as a game stopper, and is becoming available in an increasing variety of calibers. Fig. 6 illustrates what it does when it encounters animal tissue.



Gauge	a Length Overall		b Overall Diameter of Shell		c Diameter just above Rim		d Diameter of Rim		e Thickness of Rim		f Inside Diameter of Shell		g Diameter at End of Reënforce	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
12	64.50	64.95	19.95	20.15	20.39	20.59	22.15	22.35	1.55	1.65	18.55	18.75	20.10	20.30
16	64.50	64.95	18.30	18.50	18.65	18.85	20.45	20.65	1.45	1.55	16.90	17.10	18.55	18.75
20	64.50	64.95	17.10	17.30	17.48	17.68	19.10	19.30	1.35	1.55	15.70	15.90	17.28	17.48
14 mm.	64.50	64.95	14.05	14.25	14.30	14.50	15.95	16.15	1.40	1.50	12.85	13.05	14.25	14.45
12 mm.	50.00	50.50	11.55	11.70	11.70	11.90	13.40	13.60	1.40	1.50	10.15	10.35	11.70	11.85
	64.50	64.95												

Fig. 7. "Normalized" Shot-Shell Dimensions

Untinned bullet jackets and nickeled primers are coming into use, but by no means to the extent seen in the United States.

Berdan-type primers in central-fire ammunition remain universal, with the exception of a single type (caliber .38 Colt autopistol for export to South America) in which the American (Boxer) variety appears.

The "normalizing" (standardizing) of the dimensions of various cartridges as produced by all commercial makers has for some time been an accomplished fact, as has the standardizing of corresponding chamber dimensions. This was of course a much-needed reform, for Germany is full of small producers of arms, each of whom had formerly indulged his own ideas of what the dimensions of a given cartridge should be. Indeed, a high degree of standardization of specifications of both cartridges and chambers has been achieved throughout all Western Europe, through the efforts of a succession of International Commissions on the proving of small arms. These hold sessions annually, usually in a different country, and iron out differences and discrepancies. A chart showing "normalized" shot-shell dimensions as approved by the Commission appears in Fig. 7.

The differences in land and groove dimensions between the military Mauser rifle, model 1888, and the later model of 1898, still standard in the German Army, are worthy of record. Thousands of Americans own weapons of one or both types, and many of them hold the erroneous belief that they are rifled to the same specifications, or that, if anything, the bore of the former is a bit larger, as it is always called an "8-mm.", whereas careful persons refer to the latter as a "7.9-mm." However, this idea is painfully incorrect. As a matter of fact, the model '88 is bored a goodly fraction of a millimeter *smaller* than the '98, with the result that the pointed ("spitzer") bullets of the ammunition adapted to the latter are considerably oversize for it, and when fired in it will set up dangerous pressures, and vicious recoils, not to speak of shooting all over the lot. On the other hand, the round-pointed bullet of the '88 model can obviously be used with success in either of these weapons, though it naturally functions better in the rifle in which it primarily was designed to be used.

A CLEVER dodge employed at the Zella-Mehlis Proof House, one of several such institutions maintained in Germany, is that of absorbing the energy of shot charges or solid slugs fired from barrels undergoing test, by directing these toward heavy cylindrical iron bars suspended in rows from rafters above. These naturally oscillate when struck, but not being rigidly fixed and swinging freely, they do not break up under the punishment they undergo. They replace the heavy steel plates formerly used, which all too soon disintegrated under the pounding they received. These plates in turn were substituted for a still older method of firing into sand.

The production, in 7.65 and 6.35 automatic-pistol calibers, of blank ammunition loaded with compressed cardboard bullets the exact size and shape of the standard projectile, merits comment. These dummy missiles build up the pressures necessary to make possible the semiautomatic function of weapons in which they are used, thus rendering the pocket type automatic a good "Fourth of July" weapon.

Although the sale in unit packets of smokeless powder for hand loading or reloading by individuals is a practice which has long prevailed in Germany (in one caliber only, however), apparently few Americans are conversant with it. Each separate load comes wrapped in a tiny paper bag which contains an accurately measured amount of powder. Shooters unwilling to take the time and trouble to familiarize themselves with the proper loads of the different powders available, or to measure these out for themselves, can buy and use these "powder pills" secure in the knowledge that they are both playing safe, and getting the proper load for the purpose.

For the opportunity to make the above observations, I am in deepest debt to a number of German arms makers, and individuals, among them the following: The managements of August Menz, Suhl; Carl Walther, Zella-Mehlis; Deutsche Waffen u. Munitionsfabrik, Karlsruhe; Gustav Genschow & Co. (ammunition plant) Durlach; Immanuel Meffert, Suhl; Rheinisch-Westfälische Sprengstoff, Nurnberg; Sellier u. Bellot, Schöenebeck. I am likewise indebted to Gerhard Bock (of Gustav Genschow & Co.), Berlin; Dr. Ing. Walter Heess, Stuttgart; Dr. B. Kraft, Berlin; and Direktor Paul Weiss of the well-known Zella-Mehlis Proof House.

ARMY ORDNANCE

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Month by Month

THE past few months have furnished evidence galore of the mechanical fact that the pendulum will seek an equilibrium. The pendulum of popular emotion swung far to one extreme when munitions became a subject for rabble-rousing. A certain element of our population having been deprived of Prohibition as a topic of demonology, they seized upon munitions makers with all the venom that had been heaped upon distillers of alcoholic spirits until the Eighteenth Amendment was kicked out. Now we are witnessing a return to common sense even about munitions. This is a sign that not all the people can be fooled all the time.

INDUSTRIAL MOBILIZATION PLANNING

Maj. Gen. Johnson Hagood in his splendid series of articles, "Can We Defend America," published in the *Saturday Evening Post,* devoted an article to munitions (November 21, 1936). His narrative and his thesis are in the Hagood manner, which is to say that what he has written is direct, factual and sensible. Not as much can be said of columnist Brig. Gen. Hugh Johnson, who a few days before sounded off in the Scripps-Howard papers on industrial mobilization. General Hagood's defense is in much better taste and in the long run will do more for industrial preparedness and a proper appraisal of American munitions than any amount of fault-finding. General Hagood's thesis in the hands of the millions who read the *Saturday Evening Post* is the best example that the munitions pendulum will find an equilibrium.

In General Hagood's article considerable prominence is given to the work now being carried on by the Assistant Secretary of War under the terms of the National Defense Act for industrial mobilization planning. The Planning Branch in the Office of the Assistant Secretary, after years of painstaking analysis, has today reached the point where a repetition of the mistakes of 1917-1918 is utterly unthinkable. Never again will the national defense needs of our country, if a major war should come, be the haphazard disorganized problem of our pre-World War days. The Frank Scotts and the Benedict Crowells of the future will not find the Army and Navy unprepared when they take charge again. Working in close allegiance with the General Staff of the Army which determines types of equipment and tables of organization, the Office of the Assistant Secretary of War now knows what the American Army will need, in what quantities, and where and how to get it. The several supply arms and services of the War Department now know what their respective obligations are and the machine is geared to work smoothly, efficiently and effectively on an M-Day we all hope will never come.

There is no hocus in the War Department's approach to the problems of industrial mobilization planning. Many of the finest industrial minds of the country are coöperating with the War Department in this work. Scarcely a week goes by but that some one of them presents his views to the faculty and student body of the Army Industrial College. Scarcely a day passes but that the Planning Branch in the Office of the Assistant Secretary of War has the benefit of industrial practice, advice and leadership. Today more than ever before this work has evolved through years of effort to the point where industrial mobilization planning goes hand in hand with military tactics and strategy. As our great wartime Chief of Ordnance, Maj. Gen. C. C. Williams, once said, "It is to be noted that one of our best assets in expediting production in time of war is knowledge on the part of the arsenals *and* of commercial companies in the art of doing the particular work desired. This is really of vital importance in the task of mobilizing industry." . . . To keep alive the art of ordnance production and to insure some commercial activity are, he said, "to the Ordnance Department what the National Guard and Reserve Corps are to man power."

Thus it seems to us that all the munitions commotion with its political billingsgate in the long run will have accomplished very worth-while results for our national defense. Those who have been misrepresented and maligned will eventually appear in their true light. As General Hagood put it, "The World War is estimated to have cost us $45,200,000,000 including loans, bonus, and so on. Less than ten per cent of this was used for arms and ammunition. Moreover it is said that arms and ammunition were the only munitions sold to the United States during the war at a price less than that for which they had previously been sold in time of peace." This is perfectly true, of course, and there is a greater truth which even the political rabble-rouser dare not deny. We venture to say that if war should ever come the American people again will thank their stars that we still have leadership in the Army and Navy and in American industry whose devotion to the security of the United States, win, lose or draw, is not in terms of profit as some of our columnists and political spellbinders try to make it appear. As the pendulum swings, the truth will prevail, as it always has. The sound principles of industrial mobilization planning (a high-sounding phrase which means the assurance of munitions in time of war) such as we now have and as General Hagood describes them, are a guaranty that we are on the right track. No longer do so many of our people subscribe for the crazy notion that people fight because they have weapons. They now see, as Lord Raglan put it, that such a foolish statement "is equivalent to saying that people play golf because they have niblicks",

IN the last issue of Army Ordnance copious editorial reference was made to the remarkable study by Mr. Newton D. Baker entitled "Why We Went to War" as published in the October issue of *Foreign Affairs*. This impersonal analysis by our great World War Secretary of War is now published in book form by Messrs. Harper & Bros. for the Council on Foreign Relations. Many of our readers who inquired as to the availability of Mr. Baker's text will be gratified to learn that his analysis, most attractively bound and printed, can be obtained from the Council at $1.50 a copy.

Why We Went to War

In this book of 200 pages Secretary Baker tells for the first time a phase of our World War history about which there is some current discussion apropos of how to keep America out of future wars. Here is examined the conflicting evidence in the light of personal knowledge and first-hand experience. The author presents considered judgment on points long in controversy.

Were it not for the fact that this study was the subject of extended comment in our last issue we would repeat our appraisal of it here. Emphasis could be placed on the factual treatment of major influences along the road to war which Mr. Baker narrates. Students of our national defense and of the larger questions of war and peace must study this text for themselves and we urge that they do so. For us the salient attribute of the work is the author himself, his unbiased, temperate judgment which stands in marked contrast to the hysterical and extreme misinterpretations of the record by more vociferous opponents. These latter, reading their own interpretations into history, are by the contrast itself shown to have not the slightest factual concept of the real meaning of national defense. Lacking this concept they are like babes in the woods. But Secretary Baker knows the stark reality of war. His book will stand for all time as an example of what happens when a people decides that "the right is more precious than peace."

THE appearance of the September, 1936, issue of the *Command and General Staff School Quarterly* is an opportune occasion for complimenting the editor and staff of that publication upon its high and well-merited place in the military reviews of the world. Formerly entitled *A Review of Military Literature*, the masthead from now on will be simply the *Command and General Staff School Quarterly*. The change is one of title; the content and format will remain as heretofore.

Military Literature

Now in its sixteenth volume, the *Quarterly* was begun and continues as a systematic review of current military literature in which are catalogued articles of professional value in selected military and naval periodicals of the domestic and foreign field. The publication is issued as a guide to modern military tendencies and to inspire vigorous thought on the subjects treated. Its contents regularly consist of original military studies, abstracts of foreign language articles, a catalog of selected periodical articles, academic notes of the Command and General Staff School, library bulletins and a readers' guide and subject index. In other words, the *Quarterly* is an authentic and inclusive résumé of all branches of military thought throughout the world. While intended primarily for the professional soldier, this publication performs an important function alike for the civilian and the military student. On the occasion of its change of title we salute our distinguished contemporary and include in our felicitations a measure of thanks to those who have sponsored it from the beginning.

AS announced briefly on page 235, significant meetings of local posts of the Army Ordnance Association were held at Chicago and Milwaukee during December, 1936. The enthusiasm and substantial interest demonstrated at both, gave ample testimony of the patriotic zeal of our members in these areas.

For Ordnance Service

At the Chicago Club on the evening of December 1st nearly one hundred members and friends representing the industrial and engineering groups of that city, with Mr. Edmund A. Russell, president of the post, as toastmaster, assembled at dinner for a discussion of industrial mobilization planning. The principal speaker was Col. Charles T. Harris, Jr., director of the Planning Branch, Office of the Assistant Secretary of War. At a later date we hope to publish in article form the data presented by Colonel Harris. It is our purpose here to recall one aspect of this and the Milwaukee gathering as typified in the persons of the respective leaders in these areas.

Mr. Russell, whose distinguished career in American industry is well known, has been an active leader in the Ordnance cause since the World War. At the solicitation of the late Brig. Gen. Guy E. Tripp, founder of the Ordnance system of decentralized procurement, he became the war-time chief of the Chicago Ordnance District, a responsibility which he conducted to the lasting credit of the Army of the United States and with added distinction to his already distinguished career. He administered the industrial ordnance effort in an area of more than two million square miles and guided it in the speedy and efficient production of military armament for the defense forces of the United States. The Distinguished Service Medal he wears exemplifies his genius and self-sacrifice both in mobilization of the Ordnance war effort in Chicago and in the equally effective period of demobilization. When the peace-time Ordnance district organization was reconstituted in 1922, he accepted appointment as chief of the district—guiding the all-important allocation and survey of industrial facilities in accordance with the National Defense Act. Upon his retirement in 1935 he was unanimously chosen president of the Chicago Post, Army Ordnance Association, and in this capacity presided at the December meeting. Sharing the rostrum with him was his successor as district chief, Mr. Frederick A. Preston, who has endeared himself to his Ordnance associates. He is a leader in the industrial life of our country.

On the following day the annual meeting of the Milwaukee Post was held in Milwaukee. A most representative body of industrial leaders and engineers was present to hear Colonel Harris. Col. William W. Coleman, vice-president of the Army Ordnance Association and president of the Milwaukee Post, presided. Here again was an example of Ordnance leadership in the person of Colonel Coleman. Of

distinguished war-time service as a special assistant to the Chief of Ordnance of the Army in charge of artillery production, Colonel Coleman has served uninterruptedly as vice-president of our Association since its founding in 1919. In his unassuming but effective way he has kept together and enlarged the group of manufacturers and engineers of Milwaukee upon whom the Ordnance program would fall in time of national emergency. Assembled to discuss procurement planning problems with the speaker of the occasion were the executives of industrial organizations, whose commercial capacities and ingenuity are of tremendous importance to our national defense. As in the case of our other local organizations throughout the country, the leadership of the men who have sponsored and promulgated Ordnance industrial doctrine is a thing of incalculable value. These men and their associates, having rendered war-time service, know at first-hand the complexities and ramifications of ordnance production. They have not wavered in their loyalty to the cause, and today they are as sincere and as energetic in devoting their time and talents to this phase of our national defense as they were when the realities of war were upon us. In this object lesson, our citizens of today who lack the same experience are brought face to face with a loyalty which is at once a guide and an inspiration. The work of these men and their associates is written large on the pages of our industrial war effort. Similarly in time of peace they are bearing aloft the standard of industrial preparedness. The effect of their zeal will always stand as the very highest type of public service.

TANKS AND TALK

QUEER sort of a commotion that flared up several weeks ago about our American tanks! It grew out of an article in the German military review, *Militär Wochenblatt,* as published in the *New York Times.* The article expressed such grotesque opinions as the following: Our tanks and armored cars are "second-rate by European standards," our tank program "presents a wholly disorganized, planless picture." Too bad the author of the article didn't know what he was talking about. The criticisms, in part, are of experimental models long ago discarded for improved types. Which is somewhat like saying that our commercial automobiles are not up to European standards because in 1928 our car manufacturers tried a certain design but found it not up to requirements.

The author apparently believes that once our Ordnance Department, with the advice and counsel of the expert automotive engineers of our private industry, decides on building one or a few pilot models of a new design, then those pilots become standard for the Army. They do nothing of the sort. It is a perfectly grotesque statement to say that the old war-time Renault is regular equipment in our Army today. Although we still have a large number of Renaults in storage they are not "in use as regular troop equipment." They are simply in stand-by rather than in the scrap heap. Our Army has been building experimental types galore for the past fifteen years, and we have evolved types of combat vehicles which are giving highly satisfactory performances, opinion from unknowing sources to the contrary notwithstanding.

In view of the popular interest in the above criticism, the article by Major Christmas in this issue of ARMY ORDNANCE is quite timely. The author is well qualified by training and experience to state the case for our American tanks. His article was not prepared to refute any criticism; it was written before the story in *Militär Wochenblatt* was published. But, coming in the wake of the storm, it serves the very valuable added purpose of setting straight our own people—and others at home or abroad—on our first-rate tank development. As long as our tacticians know what kind of tanks they want for their military mission, there need be no fear that our Ordnance engineers and our superb private automotive industry will produce American tanks that are second-rate—judged by any standards. Let's keep the old Renaults until we have an ample supply of the present models, on the theory that a tank in hand is worth two in a Congressional promise. Our tank troubles are not matters of quality but of quantity—what new vehicles we have are fine, but we haven't nearly enough of them.

INDUSTRIAL MOBILIZATION PLAN, 1936

ON December 10, 1936, the War Department presented to the public the latest revision of its industrial mobilization plan. It has been three years since the former revised plan was issued so that the present edition brings up to date the studies and procedure for procurement planning and mobilization of industry in time of emergency. The present document is a work of the very highest order. It deserves to be read and studied by every citizen of the United States. Bearing the joint approval of the Acting Secretary of War and the Secretary of the Navy, the document coördinates the needs of both defense services from a planning standpoint. The basis of the present plan and the viewpoint from which it has been approached are succinctly stated in the foreword which we quote in its entirety:

"The accompanying plan is a revision of the plan for industrial mobilization submitted by the War Department in 1931 to the War Policies Commission appointed under the authority of Public Resolution No. 98, Seventy-first Congress, 2nd session, and published in Part 2 of the hearings before the Commission.

"The Assistant Secretary of War is charged by existing legislation with the responsibility for assurance of adequate provision for the mobilization of matériel and industrial organization essential to war-time needs. However, he has not the necessary authority to deal with questions relative to matériel except those pertaining to the Army. The Navy Department is as vitally interested in this problem as is the War Department, and it is necessary that the needs of the two Departments be coördinated in order that there be proper planning. Through joint administrative action the necessary coördination has been provided for by the establishment of the Army and Navy Munitions Board.

"In formulating this plan, there have been taken into consideration the recommendations of the War Policies Commission of March 5, 1932, and the provisions of H.R. 5529, 1935, which passed the House of Representatives, was amended by the Special Committee on Investigation of the Munitions Industry of the Senate, and recommended for passage by the above special committee, the Senate Military Affairs and the Senate Finance Committees.

"The tendency to overemphasize administrative efficiency and underemphasize national effectiveness has been guarded against. The objective of any warring nation is victory, immediate and complete. It is conceivable that a war might be conducted with such great regard for individual justice and administrative efficiency as to make impossible those evils whose existence in past wars is well known. It is also conceivable that the outcome of a war so conducted might be defeat. In all plans for preparedness and policies to be pursued in event of war it must never be overlooked that while efficiency in war is desirable, effectiveness is mandatory."

The essentials of the new mobilization plan comprise two main divisions. The first relates to procurement planning; *i.e.*, the ways and means of insuring that the defense services will (1) know what they must have in time of war and (2) how they will get it. This function of planning establishes methods for the determination of war-time munitions requirements and plans for the procurement of such requirements. The principal agency for the coördination of war procurement problems involving the Army and Navy is the Army and Navy Munitions Board. This body is now in existence and has been functioning for several years. Its studies and procedures include those vast questions of facilities, commodities, transportation, power, and fuel. It operates in peace and war.

The other main function embraces those plans for the *control* of economic resources and *mobilization* of industry in time of war. Naturally this phase of industrial war planning anticipates the measures to be employed for the proper coördination of economic resources and the plans for the organization of administrative machinery to execute these control measures. Economic control will be exerted through three inherent governmental powers: priority, price control, and commandeering.

The most powerful of the agencies, however, will be the War Resources Administration, the function of which will be to convert industry to war uses. Here will be the meeting point of the war machine and industry. This body will be the War Industries Board of 1917-1918 in its evolved, up-to-date form. It will be the first war-time national superagency established. It can operate to a limited degree under the war-time powers of the Government and existing legislative authority until additional legislation is secured to cover the full control powers anticipated in the general plan. These powers as needed will be controlled by (1) a War Trade Administration for the war-time control over imports and exports, (2) a War Labor Administration to provide the machinery for equitable and voluntary distribution of skilled and unskilled labor to industry and agriculture, (3) a Public Relations Administration (the duties of which now are being revised) to coördinate and direct the national publicity activities so that the purposes, views, and progress of the Government in prosecution of the war are properly and adequately presented to the people, (4) a Selective Service Administration (these duties also now are being revised) to govern the selection of personnel for and their induction into the armed forces, (5) a Price Control Commission to guarantee the curtailment of excess profits, the ascertainment of costs in advance and the stabilization of fair wages, and (6) a War Finance Control Commission for the control of security issues with a view to preventing unnecessary capital expenditures and to render financial assistance to industry in order that it may adjust itself to essential war-time production.

The enabling legislation to carry out the principal provision of the industrial mobilization plan is clear. Much of it is contained in existing laws and in that great undefined and undefinable grant of authority known as the war powers of the President. Delineation of the President's war powers is difficult and indeed unwarranted. However, popular opinion in recent years has subscribed to the belief that this emergency legislation should be on the statute books.

Accordingly, the War and Navy Departments have given their approval to the legislation contained in the bill H.R. 5529 (Seventy-fourth Congress, 1st session) insofar as it relates to industrial mobilization. The military and naval authorities have not approved the legislation insofar as Title I is concerned. This title is a complete war-time revenue act and obviously is beyond the scope and functions of the military. Titles II to VI of the bill are industrial in nature. They provide one or two novel enactments, the wisdom of which seems to be justified. Title II of the proposed legislation relates to industrial management. It prescribes rules for the registration of all persons in the management and control of industry. In his discretion the President "may transfer registrants to any civilian service within the jurisdiction of the War Department." Compensation of such industrially drafted persons will be paid by the Government at rates to be fixed by the President and they may not accept any other compensation from any plant in which they render service during the war. The discretionary law will have the good effect of making available a control of any individuals in any line of productive effort or service especially of those who may not coöperate or who may utilize the war emergency for inordinate personal profit.

We hope in these pages from time to time to discuss the plan itself and its various features in detail. When all is said and done, this journal and the Association which sponsors it, exist for the prime purpose of coöperating in this very endeavor. Meantime there are two pertinent observations on the present revised mobilization plan which are worthy of special comment and of sincere congratulation to the officials who have evolved the plan. More than ever the degree of coöperation between the War and Navy Departments, as is apparent throughout the plan, is a certain guaranty that the needs and activities of the two great defense services are coordinated for emergency demands. More important still is the entire dependence of this plan upon civilian rather than military control. It is a mistaken notion that the War Department and particularly the Office of the Assistant Secretary of War will try to "run" the country during a war-time emergency. Such a notion is heresy. The War Department anticipates nothing of the kind. Its views are not extremist, its policies indicate no grudge. Fortunately, the National Defense Act, under which the War Department conducts its planning activities, is careful to provide a continuing body to do the planning. If a major war should ever come and this plan is converted into practice, the War Department as such will be the first to step aside as quickly and as completely as it can, leaving the industrial job to civilian leadership and ingenuity and to the nation as a whole. The Army itself having planned well, then can enter the fray as a body of soldiers, its right arm and its sure support being always a loyal industrial effort under civilian—not military—control.

Our National Defense

An Editorial

WHAT with the incessant discussion of arms and armaments, the saber-rattling, the jingoism and the ominous portents of daily "crises" in nearly every corner of the globe, the average American may well ask, "How is it with our own national defense?" Surely we, as a peace-loving people, have no desire for war on any front either at home or abroad; we strive only to be the good neighbor to our fellows; we seek only peace for today and tomorrow as we have sought it with honor all our yesterdays. Not one of our 125,000,000 people wants war. What then is our present position for defense? Is it adequate for our proximate needs or is there cause for concern? Happily, the answers to such inquiries are assuringly in the affirmative as regards our progress toward adequacy of men and matériel ashore, afloat, and aloft. There are problems of our national defense to be sure—there always will be—but by and large, our national machine for the preservation of peace is today in finer shape than it ever has been, short of actual war. For this may we heartily thank a Chief Executive whose appraisal of national defense is sound and fearless, a Congress whose defense realism is a rare experience among us in days of peace, and a people who, despite vociferous defections of loud-speaking minority blocs, are sold on the logic and the practice of national defense insurance against war. Our Navy is now well on the way to treaty strength. Progress afloat is sure and steady. Our Army, by latest authentic report, has "the situation well in hand".

THE annual report of Gen. Malin Craig, Chief of Staff of the United States Army, was recently made public. It is for the fiscal year ended June 30, 1936. It has in it a thousand reasons why every red-blooded American citizen should stand and applaud. It shows in unmistakable terms that our military progress is very real, that the thinking behind this progress is proficiently sound, and that the men who do the thinking which achieves the progress, reveal themselves as leaders in the highest connotation of that term. In Secretary Woodring and General Craig the people of the United States have had their military defense placed on the shoulders of two men who, industrially and militarily, have shoulders worthy of the burden and intelligence equal to it. Seldom, if ever, in time of peace, has the United States reached the heights of efficiency which prevail in our Army today.

In our economy of national life, annual reports by heads of defense establishments are usually regarded as routine matters worthy of a fleeting newspaper headline and a passing thought. With readers of this journal it is otherwise. For their information we propose to undertake here a résumé of General Craig's analysis because we believe a knowledge of our military status to be of prime concern and of more than spasmodic interest.

First, let us consider the strength of our Army. The maximum peace-time strength sufficient for our Regular Army to perform its professional mission has been placed for a number of years at 165,000 enlisted men. During the fiscal year 1936, the Congress provided for this number, but, due to fiscal limitations, 147,000 was the maximum enlisted strength attained. Appropriations for the current year (fiscal, 1937) again provide for 165,000, the increase to be attained in twelve equal monthly increments. Morale has been strengthened by the enactment of legislation by which grades and ratings are adjusted to meet new conditions brought about principally by the increasing use of mechanical equipment in the Army.

The figures for our man power are worthy of a moment's reflection. They are what our national policy, based on professional analysis, puts down as required for our skeletonized standing army to meet military needs—about 15,000 officers and 165,000 men. How ridiculous the pacifist charge of militarism! If this editorial pen can figure correctly, one man in about every 700 of our population is a professional soldier. Our entire Regular Army, officers and men, if assembled at one time, could be seated in the Los Angeles Coliseum and the University of Pittsburgh Stadium. Which is only another way of saying that our Regular Army today is only about nine times the size of the police force of the City of New York.

The officer corps of the Regular Army has undergone a metamorphosis. Its morale is high, its timber is the best of American manhood, intelligence, energy, and decorum. The Promotion Act passed by the 1st session, Seventy-fourth Congress contributed largely to this result. To the civilian whose contact with the Army is not remote, there need be no reassurance that the officer corps is an alert, sincere, competent group the like of which all the democracies of history could not exceed. The shortage in numbers has been somewhat overcome by the legislative provision for the training for one year with units of the Regular Army of one thousand Reserve officers drawn from our schools and colleges. At the end of the year fifty may be selected for incorporation in the Regular Establishment. The number of officers in the Air Corps, Medical and Dental Corps, and the Corps of Engineers has been increased. From the Reserve, 1350 officers may be called to active duty for a period of five years with the Regular Army Air Corps; of this number 300 are provided for the current year (fiscal, 1937).

Before passing on to other phases of the report, we digress to urge that consideration be given to the inadequacy of numbers in the officer corps of the Ordnance Department. The Congress should realize that procurement planning is a complicated, meticulous, never-ending task, and that it is physically impossible for a mere handful of officers to survey industrial facilities of the entire nation in the apportionment of our war load to American industry.

STILL in the realm of man power but in the civilian component of it, General Craig's report discloses that the National Guard has an authorized strength of 200,000 men, although this strength is not anticipated until 1938. Steady progress has been made in National Guard training; command post exercises have served the splendid purpose of training commanders, staffs, supply, administration, and communications personnel for larger units, including the division. Motorization has gone forward in steady measure.

One hundred and twenty thousand Reserve officers in ad-

dition to the existing commissioned strength of the Regular Army and the National Guard will be required to meet a major emergency. Their proper training is of great importance. During the current year there will be trained: for 14-days active duty, some 21,300; for a period of one year, 1000; for extended active duty with the Air Corps, 300; at General and Special Service Schools, 200. This is the most liberal training program authorized since the passage of the National Defense Act in 1920.

In this connection it should be appropriate to suggest that the allotment of training funds to the arms and services by the War Department, in accordance with Congressional directive, is out of balance and should be readjusted. Today the appropriation for Reserve officer training is assigned on the basis of eighty per cent to the combatant arms and twenty per cent to the supply arms and services. This is a false appraisal of industrial mobilization; it bespeaks a minimizing of supply at a time when supply responsibilities are mounting in volume, complexity and importance. Let us train our tactical reservists by all means, but our technical reservists must be considered share and share alike—else our drillmasters may be using broomsticks for rifles in another emergency. General Craig recommends that no less than 30,000 Reserve officers be trained annually and believes that the funds now made avaiable for active-duty training are entirely inadequate. They are indeed, and the new Congress will have done well when it adopts the General's recommendation. It will have done better when it adopts the policy of active-duty training for every Reserve officer at least once in every three years, whether the assignment be tactical or technical.

The figures on R.O.T.C. and C.M.T.C. are impressive. There are 184 senior and 140 junior R.O.T.C. units. Some 150,000 young men annually receive military training at educational institutions; about 7000 of these attend R.O.T.C. camps, and an annual average of 6350 are commissioned in the Reserve Corps. Of the boys who cannot attend college the C.M.T.C. this year will train more than 30,000.

Mechanization of the Army is progressing steadily. In process of procurement is the major portion of the equipment required for the Mechanized Cavalry Brigade and all the scout cars for the thirteen mechanized platoons for employment with Regular mounted regiments of Cavalry. One Infantry tank regiment and three of the seven tank companies of Regular Infantry divisions are being equipped. Motorization likewise is progressing. Approximately 1000 tactical and administrative vehicles will have been procured during the current fiscal year; at its close, based on minimum needs, about fifty-nine per cent of the required vehicles will be on hand.

MODERNIZATION too is going ahead. Here the report states: *Field Artillery:* One battalion which operates with the Mechanized Cavalry Brigade has been motorized. Material progress is being made in the replacement of 75-mm. guns by 75-mm. howitzers in artillery units serving with the 1st Cavalry Division and the Mechanized Brigade; in the modernization of 75-mm. gun carriages, in equipping batteries with high-speed adapters so that they may be employed with motorized units, and in providing tractors for 75-mm. truck-drawn units. *Antiaircraft Artillery:* One of the five antiaircraft regiments of the Regular Army has been provided with modern equipment; the second will be so equipped during the current fiscal year. *National Guard:* In the National Guard available funds will provide, in part, for the training equipment required by antiaircraft regiments—guns, directors, prime movers, and trucks; for high-speed adapters and trucks for 155-mm. guns; two modern tanks per company and for reconnaissance cars and ambulances. *Chemical Warfare Service:* During the year 20,000 gas masks were acquired. There still remains a serious shortage in this equipment. A reserve should be built up to a point that will meet the most urgent requirements. To meet this requirement provision should be made for 100,000 gas masks annually. *Miscellaneous equipment:* Funds have been made available for the procurement of fifty-three 81-mm. mortars for the Infantry, fifty-three caliber .50 machine guns for the Infantry and Cavalry, for the production in limited numbers of caliber .30 semiautomatic rifles, an improved type of machine-gun mount, and radio equipment for mechanized units. *Airplane procurement:* Funds appropriated for this purpose will permit procurement of approximately seventy-five per cent of the total number of airplanes authorized by law to be maintained.

TWO extremely significant subjects we have left to the end. We do so for emphasis. The first relates to the fundamental policy of standardization. On this subject the report reads: "I have been convinced for some time that the lack of standardization of equipment of every variety in the Army is a distinct detriment to procurement as well as performance and that standardization is an essential not only for efficiency but to counteract the mounting cost of production. In past years there has been too much of a tendency to delay adoption of an item pending further test and improvement. There is no question that this procedure has resulted in a delay in the procurement of essential items urgently required for the training of troops, especially in new doctrine and tactics. This is particularly true in the procurement of airplanes, tanks, motor vehicles, and automatic rifles. I believe that we can standardize our equipment, purchase the best that is available at the time, and change the standards annually, if necessary, as improvements or defects develop. With this in view, action has been initiated to apply this principle throughout the service. Excellent results are anticipated." For this every advocate of the best for our national defense will cheer. Standardization means a good military machine.

And last but most important of all on the subject "Munitions" the report reads: "In a national emergency there will be an urgent need for the immediate and uninterrupted flow of munitions to the troops. To insure this involves industrial preparedness. To this end the War Department must keep up to date at all times accurate estimates of the items necessary for our forces at various stages of the mobilization. Our great industrial activities must be kept informed of specifications and details in order that they may plan to produce the munitions required. I regard this as one of the most important phases of our scheme of national defense. Without the supplies necessary for our forces, trained personnel, however numerous, will be of little avail in time of conflict." For this every advocate of the best for our national defense will give three cheers. Munitions preparedness means the best military machine.

We of the Army Ordnance Association, for this report and this program, say to the Army "Well done and Godspeed".

Association Affairs

CHICAGO POST

THE annual meeting of the Chicago Post, Army Ordnance Association, was held at the Chicago Club December 1, 1936. Mr. Edmund A. Russell, president of the Post, was toastmaster at a banquet which preceded the meeting and at which nearly one hundred members and invited guests were present. Col. C. T. Harris, Jr., director of the Planning Branch, Office of the Assistant Secretary of War, was the principal speaker. His subject was "Overcoming the Industrial Mobilization Mistakes of the World War." Mr. Frederick A. Preston, chief of the Chicago Ordnance District, outlined the plans of his organization as they are now being carried out. Col. John A. Holabird, noted architect of Chicago, urged consideration for the use of architectural and building facilities in connection with industrial mobilization planning and Lieut. Col. A. B. Johnson, executive officer of the Chicago Ordnance District, outlined the progress being made in the allocation and survey of industrial facilities for ordnance procurement.

The meeting was one of the most enthusiastic in the history of the Chicago Post and reflects great credit upon the officials of that organization. An editorial comment on this meeting and the annual meeting of the Milwaukee Post, described below, is published on page 230.

MILWAUKEE POST

ON the afternoon of December 2, 1936, some fifty industrial executives and engineers of the Milwaukee area gathered at the University Club for the opening session of the annual meeting of the Milwaukee Post, Army Ordnance Association. Col. William W. Coleman, president of the Post, presided. The meeting was in the form of a conference to discuss with Col. C. T. Harris, Jr., director of the Planning Branch, Office of the Assistant Secretary of War, the present status of industrial mobilization planning. Lieut. Col. A. B. Johnson, executive officer of the Chicago Ordnance District, was also in attendance and the entire field of ordnance procurement in the Milwaukee area was discussed in the addresses of these officers and in the questions put to them by members and guests. Later a dinner was held at the University Club, following which those present again assembled to continue the discussion of the afternoon.

Industry of Milwaukee was represented by the officials of many of the largest manufacturing enterprises of that area. In addition, Ordnance Reserve officers were also invited. The program was attractively arranged and met with general approval. Maj. L. A. Codd, executive secretary of the Army Ordnance Association, was one of the speakers at this meeting and also at the meeting of the Chicago Post.

NEW MEMBERS

THE following have recently been admitted to membership in the Army Ordnance Association: Cesare Barbieri, New York, N. Y.; Howard H. Bentley, Springfield, Ill.; Henry R. Berk, Seattle, Wash.; Wendell L. Bevan, Wilkes-Barre, Pa.; C. R. Culling, Webster Groves, Mo.; Howard M. Evarts, Buffalo, N. Y.; Stanley W. Fairman, Corning, N. Y.; Robert A. Goodpasture, Fort Collins, Colo.; J. J. Grant, St. Louis, Mo.; William J. Greene, Jr., Fairburn, Ga.; Charles H. Hoffman, Allentown, Pa.; R. F. Holcomb, Garrison, Minn.; W. L. Huff, Decatur, Ill.; Emmett Kent, Clinton, Ill.; Edward H. Kocher, Boonton, N. J.; Arthur Leach, Medina, Ohio; Harry J. Leschen, St. Louis, Mo.; Charles A. Litzkow, Chicago, Ill.; Harry T. McDonald, Peoria, Ill.; M. M. Murphy, Jr., Experiment, Ga.; Clive E. Murray, Tishomingo, Okla.; Robert C. Newman, St. Louis, Mo.; H. K. Nielsen, New York, N. Y.; Roderic Peters, Washington, D. C.; John H. Pohlman, Buffalo, N. Y.; William J. Quinlan, Washington, D. C.; Robert K. Raisler, New York, N. Y.; Walter F. Robba, New York, N. Y.; Siegfried Rosenzweig, New York, N. Y.; R. Tom Sawyer, New York, N. Y.; Herman C. Seitz, New York, N. Y.; Leonard Sheehy, Boston, Mass.; Walter C. Sherman, Rumford, R. I.; Walter Siegerist, St. Louis, Mo.; A. R. Sleath, Narberth, Pa.; Oliver C. Spurling, Upper Montclair, N. J.; Horace A. Staples, Plainfield, N. J.; Joe Sunnen, St. Louis, Mo.; H. G. Thuesen, Stillwater, Okla.; A. G. Viola, St. Louis, Mo.; William W. Wallace, Washington, D. C.; Edward H. Wells, Jr., New York, N. Y.; Harry E. Whitaker, New York, N. Y.; Victor Wichum, Brooklyn, N. Y.; Willard P. Winchester, Providence, R. I.; Harry B. Yontz, Santa Fe, N. Mex.

NECROLOGY

NOTICE has been received of the death of the following members of the Association: Frederick A. Estes, Lowell, Mass.; Tylor Field, Cincinnati, Ohio, and C. E. Seavey, Dover, N. J. To their relatives and friends ARMY ORDNANCE, on behalf of the Association membership, extends condolences.

JAMES T. SKELLY

JAMES T. SKELLY, a charter member of the Army Ordnance Association and vice-president and director of the Hercules Powder Company, died in Wilmington, Del., October 31st. He was one of the best-known men in the explosives-consuming industries, not only because of his forty-four years of service, but because of his great capacity for making friends. As chairman of the finance committee and member of the executive committee, he served his company with notable distinction and aided immeasurably in its development from its inception in 1913.

Mr. Skelly was born in Nashville, Tenn., February 23, 1877, and started his commercial career in 1892 as office boy for the Nashville branch of the Laflin and Rand Powder Company. With the purchase by the duPont Company in 1903, Mr. Skelly took charge of Laflin and Rand sales and then was placed in charge of the duPont Sporting Powder Division, along with the management of advertising. On January 1, 1913, he resigned to assume the position of vice-president in charge of sales of Hercules Powder Company.

Mr. Skelly had extended and important commercial associations. Besides his Hercules positions, he was a director of Compania Mexicana de Explosivos, Mexico City; the Union National Bank of Wilmington; Delaware Power and Light Company; Delaware Electric Power Company of Wilmington; member of the Board of Managers, Farmers' Mutual Fire Insurance Company, Wilmington; vice-president of the Institute of Makers of Explosives, New York City; member of the Executive Committee of the American Hardware Manufacturers Association, and of the Sporting Arms and Ammunition Manufacturers Institute; trustee of the American Wildlife Institute; and formerly a vice-president of the American Mining Congress.

Being deeply interested in charitable and relief work, Mr. Skelly devoted considerable time to many such organizations. He was president of the Associated Charities of Wilmington and a member of the Advisory Committee of the Visiting Nurse Association. In June, 1934, he was elected chairman of the Relief Commission, Inc., and served in that capacity until failing health last year made resignation necessary. His death deprives the Army Ordnance Association of one of its most valued members.

Ordnance Field Service

ARMY ORDNANCE SERVICE, PART II

By LIEUT. COL. RAYMOND MARSH, *Ord. Dept., U. S. Army**

ORDINARILY but one Ordnance depot is established to serve an army. However, the number to be established depends upon the military situation and certain features of terrain. When the army is operating over a wide front, one depot may require such a long haul of supplies as to render necessary the establishment of additional depots. The road-net leading forward and the rail communications in the rear also play an important part in the solution of this question.

The location, in general, should be such that the depots may remain convenient to the troops drawing supplies therefrom for the maximum time consistent with initial requirements for safety, particularly from hostile artillery fire. The facilities available also play an important part in the selection of the depot's location. Needless to say, there should be adequate railroad sidings at the depot's location. Adequate covered storage space must be available or provided with a minimum of delay. Uncovered storage space should be available in the desired quantity. The amount of space required depends, of course, upon the amount of material to be stocked at the depot. As a rule of thumb, however, approximately one square foot per man in the force to be supplied will give an approximation of the total amount of storage space required. Of this storage space, approximately one-third should be covered.

It should be borne in mind that a depot company is provided with transportation sufficient only to move its own organization impedimenta and equipment. It does not possess sufficient transportation to establish a depot, except under the most favorable conditions, where the haul is practically negligible. Similarly, the personnel provided in a depot company is not sufficient either to prepare the ground for a depot, and erect the facilities, or to provide all of the labor necessary to establish a depot, except under the most favorable circumstances; for example, where the railroad siding may run along an unloading platform which is closely adjacent to or is part of the covered storage space. Consequently, in preparing plans for the establishment of a depot, careful consideration must be given to such additional transportation, personnel, and services that may be required to establish the depot and unload the stock from the rail transportation.

In the assignment of operating personnel to the depots, if but one depot is to be established, then all three companies should be assigned to that depot. If more than one depot is to be established, the three depot companies in the army Ordnance service organization should be distributed among the several depots in accordance with the size of the several depots themselves.

After the stocks of the depots have been calculated and have been reduced to terms of tons and carloads, a schedule of desired arrival of the stocks must be drawn up and submitted as a recommendation to the army G-4 for approval and submission to the regulating officer.

Based on the foregoing, a decision can be reached as to when the depot will be ready for operations, and that time, expressed in terms of the day and the hour, should be approved by the army G-4, and announced to the army in the appropriate administration order. The troops to be supplied by each depot should, of course, be those troops in close proximity to the depot, due consideration being given to the road-net and the nature of the operations contemplated for those troops.

The depot having been established, stocked, and opened for operations, its functions will consist largely of issues to troops, and replenishment of its own stocks. Issues to troops will ordinarily be made on the authority of some form of an approved requisition. This does not mean that the request for issues must be on a prescribed requisition form. It will be seldom that this form will be used. Any request, however, from a responsible person and approved by proper authorities should be satisfied. In the early days of operation it will undoubtedly be necessary for Ordnance personnel to exercise a close scrutiny of these requests in order to prevent undue accumulation of property in the hands of organizations. But the fundamental rule should be to supply the troops with the things they need at the time and place they need them.

Stocks are maintained in the depots at prescribed levels by requisitions submitted at such periods as may be found necessary. These requisitions must be based upon actual issues, or, occasionally, upon ordered increases in the level of stocks to be maintained. When based upon issues, the requisitions for replenishment are essentially consolidations, by Ordnance property groups, of items issued since the date of the last requisition. These requisitions for replenishment of depot stocks are submitted by the army Ordnance officer to the communications-zone depot from which he is authorized to draw these items, and the replenishments are forwarded by that depot, through the regulating station, to the army depot.

In the issue of supplies to the troops, it may happen that a request is received for an item not in the army depot stocks. There are two ways in which this shortage may be filled. The Ordnance depot may obtain it through the normal channels, pick it up in its stock and issue it to the organization, or the army Ordnance service may requisition that item on a communications-zone depot with the request that it be forwarded through the regulating station to the organization desiring it on the daily train destined for that organization. In this latter case, the supply officer of the organization involved is informed as to when and where he will receive the items.

I WILL not take the time to discuss the internal operation of the general supply depot and the activities of the depot companies engaged in that operation, other than to say that an Ordnance depot company, like all other Ordnance troop units, has a dual organization—one a military organization for its internal administration and discipline, and a second, a technical organization for the performance of its special technical mission. Consequently, we find that an Ordnance depot company, in its technical organization, is divided into an administrative division and a storehouse division. The administrative division consists of four operating sections: a military section, which has to do with the military administration of the company; a depot section, which is responsible for the depot records and the operation of the prescribed method of replenishment of depot stocks; a labor section, which is responsible for the assignment of personnel within the depot and the supervision of attached labor; and a transportation section, which operates all transportation assigned to or attached to the company for the purpose of receiving, storing, and issuing supplies. This transportation section is also responsible for the proper routing and control of traffic within the depot. The storehouse division is divided into groups according to the Ordnance property classification system with such groups as may be necessary. These groups are responsible for the proper storage and issue of supplies stocked by the depot and keep the appropriate section of the administrative division informed of all issues and receipts. In turn it is informed of all authorizations for issues and for replenishment.

*This discussion presents the personal views of the author and does not represent official policy on the subject.

The question frequently arises as to why Ordnance general supply depots are not kept mobile, that is to say, established on railroad trains in rapidly moving situations. It is advantageous to do this if it is possible. As a matter of fact, this procedure was followed in supplying the American Third Army on its march to the Rhine. With a depot established on a railroad train in this manner the train may be moved to convenient points which then become the sites of the army Ordnance depot. From the viewpoint of depot operation, such an arrangement is highly desirable if for no other reason than that it makes it unnecessary to secure storage space and eliminates the requirement for considerable labor in unloading and warehousing supplies. The disadvantages, however, are that the railroad equipment employed in this mobile depot is tied up and cannot be used for other purposes and the sidings which are occupied by the trains cannot be utilized either in connection with railroad operations or for other supply and evacuation purposes.

Let us now consider that operation of army Ordnance service pertaining to ammunition supply. Here again, as in the field of general supply, the army Ordnance officer has the task of first establishing an ammmunition supply service and then operating it. As in general supply, the task of establishing ammunition supply depots involves the determination of initial stocks, location of depots, facilities required, assistance needed, assignment of operating personnel, desired time for arrival of stocks, date and hour of opening of the depots, units to be supplied by each depot, time during which issues will be made, hours when replenishment will be effected, etc. In the determination of the solution of these many problems, essentially the same basic data employed in the solution of the general supply service problem may be employed, particularly that basic data as regards the armament of the army as it is actually constituted.

THE basic policies as to the quantities of ammunition to be held in army depots and the credits held in the communications-zone depots subject to the call of the army, will be announced by the army G-4 after conference with the army G-3 as to contemplated operations. The army Ordnance officer will be informed by the army G-4 as to this policy. The army Ordnance officer will, therefore, receive information as to the quantity of ammunition which is being held subject to his call in the communications-zone depots and the location of such depots. He will also be informed that the army depots will maintain a certain stock of ammunition. This desired stock of ammunition will probably be expressed in terms of so many days of fire, or so many days of supply of ammunition, or perhaps in terms of stocks of ammunition on hand in lower echelons of the army. In all probability, the term "day of fire" will be employed.

A day of fire is an arbitrary unit which has come into wide use throughout the Army as the result of our experiences in the World War. It is not a fixed unit but it is prescribed that a day of fire will be announced by the War Department, or by the theater commander, at the beginning of each war or major campaign thereof, based upon the character of operations contemplated, and it may be changed from time to time according to experience. This term has been in use in our Army for so many years and to such an extent that it will probably continue to be used in command channels as a measure of supply. In such channels its use is not objectionable, but in supply channels its use should be vigorously resisted. From the viewpoint of supply, a day of fire means practically nothing. What is wanted in supply channels is definite information as to specific items and quantities of such items. Translated to ammunition requirements, this means number of rounds, types and quantities of components—such as fuzes, the number of packages of each of the several items, the tonnage, and in some cases, the cubic contents. Whenever the term "day of fire" is used in setting up requirements for ammunition, it simply means that the clerical work involved in converting this abstract quantity into items of supply is transferred from one office to another. This task involves considerable arithmetic, a thorough knowledge of ammunition components and methods of packing and a complete compilation of the armament of the unit involved.

The levels of stocks to be maintained having been indicated to the Ordnance officer in any one of the several phrasings indicated above, his first job is the translation of these phrases into terms of rounds, items, packages, and tons.

The round is the correct unit in which to deal with ammunition supply. Credits to subordinate units, issues, expenditures, requisitions, etc., will normally be expressed in terms of rounds. In this connection it is interesting to recall that as a result of the command post exercise held at Raritan Arsenal a couple of years ago, the Ordnance officer, GHQ, came to the conclusion that a workable system for the supply of ammunition to troops must be operated in terms of rounds as the unit of measure.

The package is the unit which must be employed in obtaining ammunition replenishment from the communications zone and in calculating transportation requirements. It must also be borne in mind that packages are not broken until they reach the hands of troops. Hence, issues will be in terms of whole boxes of ammunition in such quantities as may be required to supply the requisite number of rounds to the nearest box, or package, unit.

AMMUNITION depots are ordinarily established by the army at the rate of one per corps. This number of ammunition depots prevents the concentration of an unduly large quantity of ammunition in any one place, reduces the number of trains which will draw ammunition from any particular depot and, in general, holds the transportation of ammunition to a minimum. The basis of one ammunition establishment per corps should not be accepted as a rigid rule and in situations where one or two depots are sufficient, or where more than three are required, blind adherence should not be given to the establishment of one per corps.

The location of the ammunition depots depends largely upon the military situation. Features of terrain, transportation-net to both the front and rear, cover, facilities, and several other characteristics which might be mentioned must also be considered. The general qualifications for the location of an army ammunition depot may be enumerated briefly as follows:

It should be on the best road-net obtainable with access to front and rear. It should be as near as possible to the railroad from which it is to be restocked. It should be in rear of the distributing points for ammunition of all units which it supplies, on the basic principle that back-haul of ammunition must be avoided. It must be removed from other establishments by at least the minimum distance required for safety. It should be located beyond the extreme range of hostile mobile artillery and it should be so located that standard- or narrow-gauge spurs may be readily constructed from the main standard-gauge line throughout its area when time permits.

The establishment of an ammunition depot involves considerable labor, largely of the pick-and-shovel, strong-back type. Leavenworth is prone to teach that an ammunition depot may close at sundown at one place and open up at sunrise at another place miles away. I don't know of anything which is more inaccurate and misleading than any such doctrine. Generally speaking, it is impracticable to establish an army ammunition depot at the point of unloading the railroad cars in which the ammunition is forwarded to the depot. The necessity of separating ammunition into convenient piles, requirements for safety, and the convenience and facilities demanded in loading ammunition trains, require space, and though a standard-gauge railroad is practically essential to the forwarding of ammunition from the communications zone to army ammunition establishments, space for these establishments is likewise essential. When one realizes the areas covered by ammunition depots one must come to the conclusion that an army ammunition establishment is not

in any sense of the word a fly-by-night installation. Some years ago the Army War College actually staked out some ammunition depots on the ground as a part of its command post exercise. One depot supplied approximately one corps with four divisions in line at the time. The area on which this depot was located possessed an excellent road-net and also an excellent railroad connection. Although stocked with only 1562 tons of ammunition, it had a road space necessary for the ammunition stacks of more than three miles and covered an area of approximately two square miles. Another area which was likewise staked out, provided a depot for an army of six divisions and some GHQ troops. This depot required 19.6 miles of road for ammunition stacks and occupied an area of 63 square miles. The stock of this depot was calculated at something in excess of 19,000 tons. Without question this depot was too large. That brings us to the general rule that a depot becomes too large and unwieldy for operation if it is to be stocked with more than 6000 tons of ammunition.

It is apparent that in the stocking of ammunition in a depot of the size as sketched, both considerable labor and motor transportation are required, and in addition the area may require considerable preparation before a single pound of ammunition can be stocked. This prior preparation would include repairs to roads, construction of ditches, possibly the erection of temporary shacks for the shelter of the more perishable types of ammunition, the clearing away of brush under natural cover, etc. It is likewise apparent that an Ordnance ammunition company, with its exceedingly limited transportation and small strength, is unable either to prepare the area for the depot or actually to unload the ammunition when it arrives. In general, the Engineer Corps, through its army Engineer service, will perform the tasks involved in preparing the ground for the depot, and the Quartermaster Corps, through its army Quartermaster services, will provide the additional labor and transportation needed in the establishment and operation of the depot.

In the army Ordnance service, three ammunition companies are provided. On the basis of one depot per corps, one company can provide the necessary administrative, supervisory, guard, and control personnel needed for the operation of the depot of that size. The plans of the army Ordnance officer must include the assignment of these several ammunition companies to definite ammunition depots.

With initial stocks determined, the location selected, the sites prepared, and operating personnel assigned, a schedule of the desired arrival of the ammunition trains for the initial stocking of the depot may be prepared. This schedule is then submitted to the army G-4 for approval and transmission to the regulating officer. With the approval of the schedules of incoming trains of ammunition, the hour of opening the several depots may be determined. This, together with their locations and the troops to be supplied by each depot, will be published to the army in an appropriate administrative order.

Issues from army ammunition depots are made to troops on the basis of an ammunition allocation to those units. The army Ordnance officer is informed by the army G-4 as to these allocations and he in turn informs the several depots so that they may know the quantities of ammunition which they may be called upon to issue, and the authority for such issues.

THE fact that ammunition supply in the field in time of war operates on the basis of credits and allocations necessitates certain ammunition records in addition to the field equivalent of stock record accounts. In addition to the records covering his ammunition stocks, the army Ordnance officer must also keep an account of his credits back in the communications zone and an account covering the allocations and issues made to components of the army. Likewise, each army ammunition depot must keep a record of its own stocks and another record of allocations and issues made to the units which it supplies. The very nature of ammunition supply indicates the necessity for keeping these records up to date. They should be posted frequently, at least daily.

The maintenance of stocks in army ammunition depots at the prescribed levels is accomplished through the operation of the system of expenditure reports and requisitions. All ammunition expenditure reports, after consolidation in the headquarters of the lower echelon, finally reach the army Ordnance officer. Likewise, reports of issues from his several depots will be forwarded to him. After a consideration of expenditures and issues and present stocks it may readily be determined what additional quantities of ammunition must be received from the commmunications zone in order to hold the army ammunition stocks at the desired levels.

It is not sufficient merely to thus determine the quantities of ammunition required. The requirements of ammunition must be divided definitely and accurately among the several ammunition depots in accordance with their individual needs. Requisitions for ammunition must, therefore, be prepared for each depot. These requisitions in some form are submitted to the proper ammunition depot in the communications zone where ammunition credits for the army have been established. In certain situations, these requisitions may be submitted to the Ordnance officer of the communications zone, to the chief Ordnance officer of the theater of operations or to the regulating officer. In any case, the regulating officer is furnished a copy of each requisition. So, also, is the army G-4 and the army ammunition depots concerned. When notice of shipment is received and the regulating officer informs the army Ordnance officer of the date and hours of arrival of these ammunition shipments, the depots involved are informed immediately. It is necessary to inform the depots immediately so that arrangements can be made to unload the shipment promptly. Arrangements for any additional labor and motor transportation that may be required to handle these incoming shipments are made with the army Quartermaster.

In connection with replenishment, it must be borne in mind that it is practically impossible to make issues of ammunition and receive replenishment at the same time. Consequently, there must be a very high degree of coördination between the times at which issues will be made and the times at which it is desired to receive replenishment and actually restock the depot.

The army Ordnance officer is charged with the full responsibility for the satisfactory operation of the army ammunition supply service. This responsibility extends down to and includes such refilling points as may be established in addition to the regular depots. While he has this responsibility, it must be realized that the only means at his disposal for meeting it are the three ammunition companies provided in the army Ordnance service. He must rely upon the railroad transportation service for deliveries. Service trains from corps and divisions call for the ammunition. The Engineer Corps assists in the preparation of the sites of the depots. The Quartermaster Corps supplies the bulk of the labor and transportation required in the initial stocking and internal operation of the depot. The Ordnance company is able to supply only the administrative, supervisory and controlling personnel. (*To be concluded in the next issue.*)

Editor's Note—After the conclusion of this series of articles on Ordnance Service in the March-April issue of this journal, the author will begin the presentation of a discussion entitled "Field Service Problems"—a subject of especial importance dealing with the supply and maintenance in service and in storage of all matériel stored and issued by the Ordnance Department of the United States Army. This will begin in the May-June issue.

Professional Notes

THE PASSING OF THE '86

By ALLEN P. WESCOTT*

ON the eve of its fiftieth birthday, comes word that the famous old 1886 Winchester, known in recent years as the model '86, has been discontinued in favor of the new model 71. The retirement of this old favorite will be regretted by many lovers of the lever action. It was easily the smoothest, most rugged, and least likely to malfunction of all lever-action rifles, and there is much consolation in the fact that the new 71 is based on the proven action of the '86, retaining all its advantages plus certain refinements necessary to make it strictly modern.

The Winchester is descended from the Jennings (1849), the Volcanic invented by Horace Smith and D. B. Wesson (1851-1854), and the rifle patented by B. Tyler Henry in 1860. The Henry was made by the New Haven Arms Company where B. T. Henry was employed. Oliver F. Winchester, at one time lieutenant governor of Connecticut, was president and principal owner. In 1866 the firm was reorganized as the Winchester Repeating Arms Company and the 1866 Winchester was placed on the market. This was the Henry as improved by Nelson King, and the first of a long line of Winchesters. The 1866, like the earlier Henry, was chambered for a rim-fire cartridge.

The Henry saw service in the hands of cavalrymen during the last years of the Civil War, and following the war, Henrys and '66 Winchesters were used by frontiersmen and buffalo hunters. These rifles guarded frontier settlements, ranches, cattle trails, wagon trains, and the workmen engaged in the construction of the Union Pacific Railroad, and, incidently, they furnished buffalo meat to these same workmen. So the Winchester may be said to have aided materially in the westward tide of empire. Not only were these rifles used for protection against hostile plains Indians, but frequently they found their way into Indian hands, many of them being used by Sioux and Cheyennes in the battle at Little Big Horn where Custer's small command was annihilated. The 1866 enjoyed a long life and was listed in Winchester catalogs as late as 1897. Mexico purchased some of these first Winchesters in 1866 when Don Benito Juarez was fighting the forces of Maximilian. It is said that they were used against the French Foreign Legion at Monterey. Turkey obtained 30,000 arms of this model about 1871 and they were used, along with American Peabody-Martinis, in the war with Russia, 1877-1878. It is reported, that the Turks, using '66 Winchesters, laid down the first barrage in history.

The 1866 was followed by the even more renowned model of 1873 made in .32-20, .38-40 and .44-40 center-fires. The "forty-four-forty" was especially famous, being a favorite with Buffalo Bill, Annie Oakley, and Doc Carver. Though used more as a deer gun than for any other purpose, it probably accounted for more bison than did the heavy Sharps and other long-range single-shot rifles usually classed as buffalo guns. The '73 was popular not only in the West but from the Arctic Circle to the tropical jungles of Latin America as well. It has been used widely in Canada and Mexico, in the Maine woods, the Adirondacks, and in the South. It found its way from frozen tundras to South African veldts and made the name Winchester famous throughout the world. Winchesters have seen much guerilla warfare during the countless insurrections and sanguinary civil wars that have wracked the states of South and Central America.

Without tools, the lever-action repeater cannot be dismounted for thorough cleaning as easily as can the bolt-action, but the Winchester usually functioned well under the most adverse conditions. Prospectors, hunters, and explorers carried it into arid deserts where its action was filled with dust and sand. In the Brazilian hinterlands it was exposed to moisture, humidity, and consequent rust. In the Yukon it was subjected to subzero temperatures, and on sealing and trading schooners it had to contend with salt air and sea water. Prior to the advent of this model, riflemen were skeptical of repeaters, regarding the less complicated single-shot as more dependable, but with the excellent performance of this arm confidence in the repeater was gradually developed until the '73 began to displace the single-shot rifle. It eventually became almost universal and for decades reigned supreme—successfully resisting the encroachment of high-power bolt-action arms. Revolvers were made by Colt, Smith & Wesson, Merwin & Hulbert, and others, chambered for the .44 Winchester cartridge. Like the '66, the '73 was offered in musket and carbine as well as sporting rifle. The '73 also enjoyed a long life, its manufacture not being discontinued until sometime after the World War. Thousands of them are still in use. The Marlin, Remington, Colt, Kennedy, and many other rifles, were chambered for the .44 W.C.F. cartridge which continued to meet with considerable favor long after the development of many superior loads.

WINCHESTER'S next contribution was the Centennial Model of 1876, chambered for cartridges somewhat more powerful than those of the '73. (Note that both the '66 and '73 used revolver cartridges only.) These were the .45-75, .45-60, .40-60 and the .50-95 Express. The '76 never enjoyed the popularity of the '73 nor of the superior '86 which followed. Some of the .45-75 rifles were of military type and were equipped with bayonets. The writer has, in his collection, a .45-75 cartridge that is a relic of the Sino-Japanese War of 1894-1895. It was brought back by Capt. Philo Norton McGiffin, American commander of the Chinese ironclad CHEN YUEN in the battle of Yalu. Captain McGiffin, a native of Washington, Pa., has been immortalized by Richard Harding Davis in "Real Soldiers of Fortune." The Royal Northwest Mounted Police adopted the 1876 carbine and used it until late in the 1880's. It was used by them in the suppression of the Reil Rebellion in 1878. A few of this model were made for a huge cartridge known as the .70-140 W.C.F.

THE WINCHESTER RIFLE, MODEL 1886

When the Winchester Company was twenty years old, they

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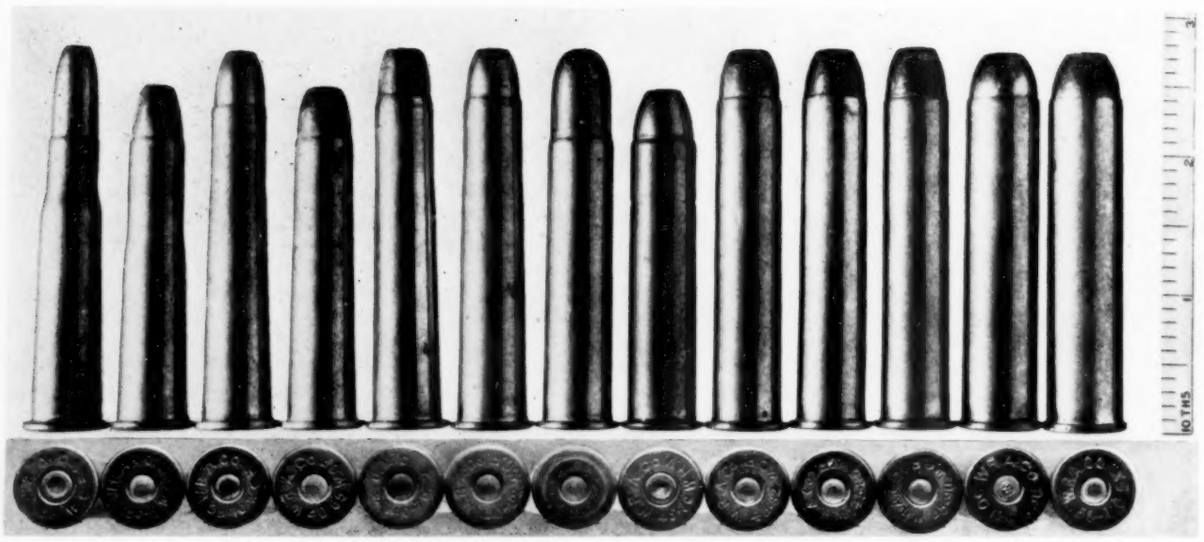

CARTRIDGES ADAPTED TO THE 1886 WINCHESTER

Left to right: (1) .33 W.C.F., 200-grain bullet; (2) .38-56-255; (3) .38-70-255; (4) .40-65-260; (5) .40-70-330; (6) .40-82-260; (7) .45-70-500; (8) .45-70 W.H.V., 300-grain bullet; (9) .45-82-405; (10) .45-85-350; (11) .45-90-300; (12) .50-100-450; (13) .50-110 Ex., 300-grain bullet.

brought out the 1886 model which was, and still is, if we disregard the new 71, the acme of all lever-action repeaters. Never was there a faster, smoother, or more dependable lever-action arm. The '86 was, in common with so many superior arms, the invention of John M. Browning. It too, was a tubular-magazine rifle but had a much stronger action than that of earlier Winchesters. This arm was made for the .45-70 Government cartridge and also for the .45-90, .40-82, .40-65, .38-56, and later for the .38-70, .40-70, .50-100 and .50-110 Express. In 1900, it was furnished with nickel-steel barrel and adapted to the .33 W.C.F. cartridge. The .33 was the only high-power cartridge for this rifle, although there were several high-velocity loads. Incidently, the 1895 Marlin was adapted to most of the cartridges for which the '86 Winchester was made.

The '86 was furnished either with full or half magazine, with or without pistol grip, take-down or solid frame, rifle or shotgun-type butt plate, plain or fancy stock, round or octagon barrel. The action was locked by two upright bolts fitted into slots on either side of the receiver. Depressing the lever draws the bolts downward clearing the grooves in the receiver. This movement ejects the fired empty and permits the breech bolt to move rearward, cocking the arm. At the same time, a cartridge from the magazine is raised to a position in the rear of the chamber. Pulling the lever back carries this cartridge into the chamber, and the two bolts move upward and lock the arm. Only a very short movement of the hand is required to work this action, which, in common with the similar 1892, is the quickest and easiest of all lever actions to operate and one almost never known to jam. The .33 has a 24-inch barrel; most of the others have 26-inch barrels except the .45-70 lightweight which is carbine length (22-inch barrel). Because of the length of the cartridges, the magazine capacity is rather less than the '73, being seven to nine cartridges in the full-length magazine or four in the half magazine. The fit and hang of this rifle approach the ideal for the average shooter, and the '86 remained a favorite long after the cartridges for which it was made became hopelessly obsolete. Colonel Whelen said ("The American Rifle," p. 33): "While this rifle will not have the long-range accuracy and great killing power of some of the models carrying more modern cartridges, it will probably give more satisfaction to its owner than any other big-game rifle that he has ever owned. It might also be said that this is probably the very best rifle for a left-handed shooter." Even the 1895 Winchester, chambered for vastly superior cartridges—cartridges that may still be considered modern—never attained the popularity of the '86.

When the .32, .38, and .44 W.C.F. cartridges were supplemented by the .32, .38, and .44 W.H.V. (high velocity) series, the 1892 Winchester was introduced to use them, and also the .25-20 (repeater) cartridge. The 1892 is almost exactly like the '86 except in caliber. The 1894 model which followed the 1892, lacks the two vertical locking bolts of the '86 and the '92 but is sufficiently strong for the loads for which it was made. The '94 was designed originally for two excellent deer and Schuetzen cartridges, the .32-40 and .38-55 Ballards. The following year the .30-30 appeared and later the .25-35 and .32 Special. The .30-30 is a popular deer cartridge and one of the best-known sporting loads in the world. An enormous number of 1894 Winchesters of this caliber have been sold. The "treinta-treinta Winchester" was the standard arm of the famous Mexican Rurales during the régime of Porfirio Diaz. Despite the popularity of this model, many riflemen feel that the Winchester Company made a grave mistake in bringing it out rather than adapting the '86 to the .32-40, .38-55, .25-35, .30-30, and .32 Special cartridges. Since there were military editions of the 1866, 1873, 1876, 1883 (Hotchkiss), 1892, 1895, and the Lee Straight Pull, it seems strange that only a small number of caliber .45 muskets, model 1886, were made, particularly as the .45-70 was a military cartridge.

ASIDE from the high-power .33, the .45-70-405 and the .45-70-500 Government cartridges were probably the best of all those for which the '86 was chambered. These cartridges were also used in Springfield, Hotchkiss, Remington-Lee, Remington Keene, 1879 Lee, Ward-Burton, Ballard Pacific, Burgess, Phoenix, Sharps Borchardt, Chaffee-Reece, Peabody, Peabody-Martini, Franklin, Bullard, Buck, Whitney, and other rifles, both sporting and military, and in Gatling, Lowell, and Gardner machine guns. Although the .45-70 was primarily an army cartridge, it was admirably adapted to hunting such American big game as moose, elk, caribou, musk oxen, Alaskan brown bears and grizzlies, and though unnecessarily powerful for deer, black bear, wolves, and mountain lions, it gave good results when so used. Because it was accurate at long ranges, compared with contemporary cartridges, it was, prior to the development of more modern ones, widely used for long shots at big horn sheep, mountain goats, and antelope. Had the '86 Winchester appeared when the .45 Govern-

ment cartridge did (about 1873), this rifle and load would undoubtedly have proved a most popular combination for the buffalo hunter. The development of the .45-70 W.H.V., a smokeless cartridge with a 300-grain jacketed bullet and a much higher velocity than the .45-70-405 (or 500), gave these rifles a new lease on life, and the .45-90 and .50-110 were similarly speeded up. A few years ago the '86 was discontinued in all calibers except .33. The .33 is a good cartridge for all but the largest of North American game, though none too accurate at longer ranges. The popularity of the .33 was not due to the cartridge but to the fast and dependable action of the 1886 rifle.

During half a century of faithful service, the '86 has earned a place in the hearts of American riflemen, and even the bolt-action addicts would be saddened at the thought that it had gone the way of the Sharps and Ballard but for the fact that its action survives in the new 71. The new .357 Winchester cartridge with an 150-grain bullet has a muzzle velocity of 2930 feet per second, or a velocity of 2535 feet per second with a 200-grain bullet. By way of comparison, we might mention that the .30-'06 cartridge, also with an 150-grain bullet, is only 2700 feet per second, and the velocities of both the .30 and .33 Winchester are 2200 feet per second. Since the 71 is not handicapped by obsolete ammunition, it is confidently expected that this new rifle will measure up to the traditions of the time-honored '86.

The Use of Lead Equipment in Handling Acids

WHILE lead has many useful and necessary applications, one of the most interesting is its use in connection with the manufacturing and handling of various acid solutions.

The class of lead used has an important bearing as to the service and life of this metal in contact with acids. "Chemical lead," in the form of sheet lead and pipe, is the most suitable according to general chemical tests and research. This is a designation which has been used in the trade for many years to describe the undesilverized lead produced from southeastern Missouri ores.

Chemical lead is produced from the sulphide ore, galena, in a blast furnace after roasting, or in a Scotch hearth furnace, and is refined without desilverization. Slight traces of copper are present which is considered advantageous; other impurities are practically negligible. The composition of this lead produced year after year is remarkably constant.

For some uses in the chemical and allied industries, lead itself lacks sufficient mechanical strength, so this has been taken care of in two ways. First, there is the use of lead as a lining for pieces of equipment whereby the acid-resisting qualities of lead are combined with the strength of iron or steel. Secondly, there is the use of hard lead, and while cast-lead products are not suitable for as high working pressures as lead-lined products, still they offer greater strength than the straight-lead product and can be used at normal temperatures under pressures up to sixty pounds.

Wherever acid-resisting equipment is necessary for the handling of sulphuric acid and allied acids, lead or lead-lined products are the logical solution because they have the acid-resisting qualities and the strength necessary for maintaining high pressure, which is absolutely essential in these days when the demand calls for economical and continuous production.

The first requisites for the conveying of acid are piping and valves, or some other means of controlling the flow of solutions. The use of storage or supply tanks is also entailed, and as it is not possible to have gravity flow at all times, pumps or air lifts are necessary to convey solutions to the succeeding stages of operation. The lead-lined piping can consist of steel, which is the most commonly used or, if necessary, copper or brass. In order to simplify the description of the various processes, reference to metals other than steel or lead will be eliminated. It can be understood from the foregoing that it is possible to secure other metals lined or covered with lead and the same general process of manufacturing as entailed for the steel product would be used.

Steel pipe is treated to thoroughly cleanse it, after which it is fluxed with a bonding medium. The required lead tubing or piping is manufactured in the usual manner by extrusion and in the process, the lead pipe receives a coating of a bonding medium on the outside only. The lead tube then is inserted carefully into the steel pipe and the lead pipe is expanded tightly against the wall of the steel pipe.

The second step is to fuse the lead and the steel together, which is accomplished by steam pressure, the temperature of which is sufficient to melt the flux and bring about an inseparable bond between the lead tubing and the steel pipe. This pipe is furnished in random lengths the same as standard steel pipe, which runs, depending upon the diameter, from sixteen to twenty-two feet long. The ends of pipe are furnished threaded, and the installation can be made either with threaded or flanged connections. However, the most practical method of joining the pipe is with flanges, for in this manner, assurance is given that a one hundred per cent lead contact will be secured through an entire run of the piping.

Flanges for making on to the pipe are first lead lined, such lead lining being flush with the face of the steel flange and extending to slightly within the bolt circle. The flange is then screwed on to the pipe and the lead made continuous by lead burning or by welding the lead lining of the flange to the lead lining of the pipe.

Flanged fittings usually are manufactured of cast iron and furnished from a standard 125-pound pressure pattern. For lining purposes, however, as fittings usually increase to a considerable extent the amount of friction necessary to move a certain quantity of solution, the cast iron fittings should be cast with a larger internal diameter than normally specified. The lead lining is then inserted—the approximate thickness of the lining being one-quarter of an inch—and after lining the full internal diameter of the fittings is retained, thereby reducing friction to a minimum. The faces of the flanged fittings are lead lined in the same manner as the flanges which are used for the pipe, and therefore when bolting the two together, a positive lead-to-lead contact is had.

Acid valves of various types are manufactured in both lead-lined and hard-lead patterns. The type of valve usually specified

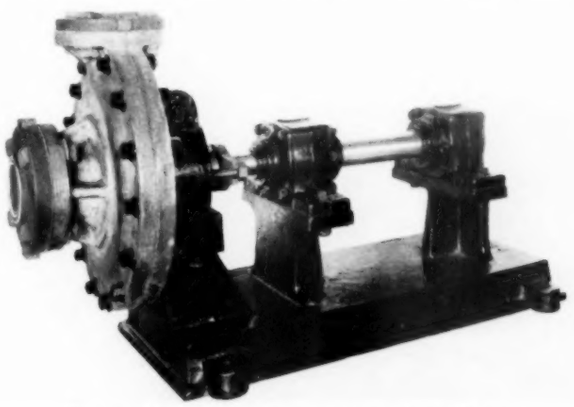

FIG. 1. HARD-LEAD CENTRIFUGAL ACID PUMP WITH DIRECT OR BELT DRIVE

is the "Y" pattern or what is known as a free-flow valve. The reason for this is that many acids contain grit, and if a type of valve is used which would permit the grit to accumulate at the seating surface, scoring of the lead plug normally would result and cause the valve to leak. For some conditions, where strong acids are not being handled, or the temperature does not exceed 180 degrees Fahrenheit, valves are equipped with a removable

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rubber plug which can be renewed easily and which possesses some self-seating qualities. Where conditions require, other patterns of valves can be furnished, such as globe, gate, angle pattern, also checks and foot valves for pumping conditions.

Where a gravity flow is not possible, acid pumps become a necessity (Fig. 1). There are two types of hard-lead acid pumps: the open-pattern centrifugal type, and the vertical pump—the latter not requiring a stuffing box. The open-type centrifugal pump, however, is the one most commonly used, and this is similar to a standard cast-iron pump, except that the casing is cast entirely of antimonial lead, and all parts with which the solution would come in contact are of a similar metal. The advantage of the vertical type of pump is in the fact that no stuffing box is required, but such type of pump is limited in its use. It is generally used where solutions are not to be pumped to any great distance or, in other words, low head, although they will deliver large volumes of acid.

The hard lead designated in the manufacture of certain types of valves and all acid pumps is a cast metal composed of chemical lead with the addition of approximately six to eight per cent of antimony.

One of the most interesting developments in connection with lead-lined equipment, where strength is of prime importance, is the manufacture of homogeneous lined apparatus, such as storage tanks, autoclaves, and jacketed pressure tanks of all descriptions. Over a period of years, the industry struggled along with loose lead-lined equipment or, in some cases, with partially bonded apparatus, but the life of such material was very short and, in addition, required continuous maintenance. Later developments brought about the use of tin for bonding purposes, but even this class of material was not as efficient as desired, for the temperature range was limited to the neighborhood of 300 to 350 degrees Fahrenheit. Even though the apparatus withstood the maximum temperature as given, continuous heating and cooling operations soon developed weaknesses in the bond and blisters and breaks in the lining resulted.

This process, however, has developed to the extent that homogeneous equipment now can be secured in which the lead linings are bonded to the steel or other metals with a nonmetallic flux. Such linings are therefore not subjected to the same faults as earlier equipment but can be used under various conditions of operation, such as high steam pressures, vacuum, etc., and the lead linings will not separate or come off unless heat is applied close to the melting point of lead (621 degrees Fahrenheit).

THE most successful way to manufacture homogeneous equipment, if the apparatus permits, is to treat the steel in order to cleanse it thoroughly, after which the required thickness of lining is applied to the flat sheets. The application of the lead to the steel is a casting process, and the lead is applied several times heavier than the final requirements. This is advisable, for surface porosity often prevails in a cast-lead process, and by a method of removing the excess lead, such possibility is eliminated. A minimum final lead thickness of three-sixteenths of an inch is at all times recommended. When the bonding process of the lead to the steel is completed, the lead-covered sheets are machined in order to secure a smooth surface. In machining off the excess lead, a knife or cutter used for such purpose is followed by a pressure roller in order to increase the density of the lead. The sheets are then rolled in a similar manner, as in the fabrication of plain steel tanks, to whatever shapes or sizes may be necessary. The procedure generally recommended for making joints is to electrically weld the steel and when this work is finished, to line with lead the small area at the section of weld which has been left bare up to this point. The lining of this joint is similar to the remaining process, so that when the apparatus is completed, except for the outside seam in the weld, there are no indications in the lead surface as to where a joint may exist. Homogeneous lead-lined equipment has been perfected to the extent that

specifications covering such products can be written along the following lines: The two metals, lead and steel, shall be so attached together that they are inseparable close to the melting point of lead and capable of withstanding shock, vibration, vacuum, and rapid changes in temperature.

Homogeneous lead-lined jacketed vessels offer the opportunity to operate at 125 to 150 pounds steam pressure, and while in many cases these operating pressures are a valuable asset from the standpoint of time, it is not always economical and practical to make an installation of this type. In such cases coils are indicated. Lead coils can be used only up to maximum steam pressures of forty pounds, so for the higher pressures the lead must be reënforced.

Lead-covered steel coils have been used at various times but unsatisfactory results were secured. The faults which developed were mainly due to porosity. This, no doubt, was brought about by the method of covering the steel pipe—which was to apply the covering by burning on the required thickness of lead with a lead-burner's torch. This procedure has been eliminated and the more practical and satisfactory method, that of a homogeneous lead covering, has been devised.

For the manufacturing of homogeneous lead-covered coils, it is both advisable and desirable to use copper tubing. Copper tubing lends itself more readily to the homogeneous covering with lead and also facilitates bending. Lead-covered copper coils can be successfully bent to fairly small diameters and, as will be appreciated, where lead-covered copper material is involved, all bending must be performed cold.

Copper tubing in straight lengths, approximately twenty feet long, are homogeneously lead covered by casting on the lead. The casting operation is performed by covering a number of tubes at the same time—the covering being applied in a mold. The lead covering is applied several times heavier than the final specifications. The suggested minimum thickness of covering should be the same as for steel sheets—not less than three-sixteenths of an inch. After the casting process has been completed, the tubes are run through a draw bench where the lead thickness is decreased to the final requirement, which is, as mentioned, at all times a minimum of three-sixteentths of an inch. After this, the lead-covered tubes are formed to whatever diameter and type of coil may be required. The joints between the sections of lead-covered tubing are made by the cup method and the copper is brazed together with silver solder. The continuity of the lead covering is continued over such joints by molding on the required lead.

THE specified pitch of the coils is maintained by casting into place lead spacer blocks. The lead spacer blocks are continued beyond the bottom of the coil to whatever length may be necessary in order to form a support or legs so that the coil will not rest upon the bottom of the equipment. Coils of the foregoing description are manufactured to withstand 150 pounds working pressure, and with this type of heating unit, maximum heat transmission is secured. It is stated that homogeneous coils eliminate the many past difficulties as experienced with all lead coils under their maximum operating pressure, such as weaving out of shape and bursting, with resulting expense for repairs and loss in production. The most generally accepted design of homogeneous lead-covered coil is the helical type, although, in many cases, it is necessary to use the pancake or beehive type.

The homogeneous process is also applied to the covering of agitators, propellers, and mixing devices of all descriptions. It is particularly advantageous in this respect, for, in many cases, a lead contact is necessary and without the homogeneous principle of applying the lead, rigidity and durability which result in economical operation are not possible.

For the convenience of readers who are not members of the Army Ordnance Association, an application for membership is printed on page 254 of this issue. Recommend it to your friends.

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AOA

Chronicle

PENDING the revision of Army Regulation 850-50 all communications relating to inventions, including suggestions, ideas, or plans for new war matériel or the improvement of existing matériel, will be referred directly to the Adjutant General who will secure the drawings, models, etc., necessary for a correct understanding of the device. These will be forwarded to the most interested arm or service for an opinion as to the military value. However, invention data received directly by chiefs of the supply arms or services will be coördinated with other interested arms and services as to military value before forwarding to the Adjutant General, if the information received is complete enough to warrant proper consideration of the device. Moreover, the chiefs of the supply arms and services will not be required to refer invention data originating within their own branch in connection with the approved development of matériel for which they have the responsibility of design, development or procurement. If the device has no military value the Adjutant General will so inform the inventor. If it has such value it will be referred to the interested supply arm or service for direct arrangement with the inventor for use of the device by the United States and for patent protection, if this has not already been arranged.

Maj. Gen. Frank Parker, commanding general of the Third Army and the Eighth Corps Area, having reached the statutory age, has retired from active Army service. Appointed to West Point from South Carolina he was graduated in 1894. His first service was with troops on the Mexican Border as second lieutenant, followed by service in the Spanish American War and in the occupation of Puerto Rico. He later was assigned as Military Attaché to Venezuela and Argentina. Reporting for duty in Cuba in 1906, he formed the Rural Cavalry there. During the World War, General Parker served first as head of the American Military Mission at French GHQ, later being assigned to command of the 18th Infantry of the 1st Division of which he became commander. General Parker was promoted to the rank of major general in 1929 and assigned to command the Sixth Corps Area. After two years service in the Philippines he served briefly as commander of his wartime organization, the 1st Division, later being assigned to the command of the Third Army and the Eighth Corps Area.

ACCORDING to the American-Swedish News Exchange, bridges made from cardboard were used successfully during recent Swedish Army maneuvers. They were found to be buoyant, cheap, and easy to transport, as well as strong enough to support considerable weight. Eventually they disintegrated in the water—saving the engineers the trouble of "burning their bridges behind them."

The National Defense Committee of the American Legion has recommended the continued modernization of arms and equipment particularly antiaircraft and antitank weapons, and also an increase of mechanized forces and motorized equipment. The Committee likewise recommended completed plans for service of supply in time of war and funds for placing educational orders of war matériel with private companies for the production of equipment not usually produced by industry. Such orders should include gages, dies, tools, fixtures, etc., so that private industry would be prepared to provide men and material for the speedy manufacture of war equipment and munitions in time of emergency.

Army lieutenants will be no longer eligible for selection as

student officers for the Army Industrial College beginning with the collegiate year 1937-1938, according to a War Department directive. Captaincy is now the lowest grade eligible for attendance.

Either 14- or 16-inch guns will be mounted on the two new U. S. battleships which are expected to be laid down this month, it was intimated some time ago at a press conference held by Secretary of the Navy Swanson. The decision as to the size of the guns will be final when made, despite the fact that Japan has until April 1, 1937 to state its intentions as to the size of future naval armament.

THE Secretary of War has announced the award of a contract for 117 basic training planes for use at the Air Corps Primary Flying School, Randolph Field. The contract, including provision for spare parts, amounts to $1,432,600. This new basic trainer embodies a great advance in design over the type in use since 1930. The new plane is powered with a Wright single-row radial engine, developing 400 horsepower—its high and landing speeds being between those of the primary training plane and the combat planes used in tactical units.

Dr. Robert A. Millikan, California Institute of Technology, Pasadena, Calif., released five sounding balloons carrying sets of cosmic-ray recording apparatus from the Quadrangle of the Eighth Corps Area headquarters at Fort Sam Houston. The instruments recorded air pressure and cosmic ray intensity by means of needles which cast shadows, leaving traces on a photographic film.

The National Guard Bureau has issued instructions establishing a uniform method for rendering small arms unusuable in case they should be stolen. The instructions provide for the removal of the bolt assembly from caliber .22 rifles; the striker from caliber .30 rifles (a small metal disk being assembled in its place); the magazine catch from pistols; the firing pin from Browning automatic rifles; and the extractor assembly from the Browning machine gun. These removed parts are to be stored in a secure but readily accessible place.

MAJ. GEN. GEORGE VAN HORN MOSELEY, speaking at a critique following recent maneuvers of the Third Army, gave a unique instance of necessity becoming the mother of invention when a dearth of gas masks threatened the Blue force. Maj. E. C. Bomar, Ord. Dept., fashioned a "home-made" mask by cutting a small section of an automobile inner tube to fit over the face and stretching the other end over a tin can. The eyes were protected by a cheap pair of goggles. Maj. Maurice E. Barker, Chemical Warfare Service, then filled the can with a combination of substances which gave almost entire protection, and later improved the entire mask. In his report to General Moseley on this endeavor, Major Barker stated: "There is handed you herewith a gas mask capable of emergency manufacture from materials purchased locally. . . . The mask should be effective against all war gases except the irritant smokes and the cyanide gases in high concentration. . . . It has been tested by actual wear for short periods against chlorpicrin, phosgene, and tear gas in high field concentrations. No gas reached the wearer during tests." In the opinion of General Moseley, this mask could be manufactured promptly and in quantity for thirty or forty cents, whereas he had been informed a regulation mask cost about $14.50. "I consider this matter worth all the maneuvers have cost us in effort and money," he said.

The Navy is to have a huge new floating drydock at Pearl Harbor for the use of the fleet. The dock, considered by some to be of experimental design, will cost approximately fifteen million dollars and will take over two years to build. It will be so large that existing building ways cannot be utilized economically in its construction, necessitating the digging of a mammoth shore drydock in which the floating dock can be built. When completed the great structure will be towed to Pearl Harbor.

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Book Reviews

THOSE FATAL GENERALS. By E. V. Westrate. New York: Knight Publications, Inc. 1936. $3.00.

SO astounding is the story of America's military leadership as unfolded by Mr. Westrate that many readers may at first suspect that the author is embarking upon a "muckraking expedition." This is not so. Neither pacifistic radicalism, nor other sophistry, receives any comfort from this book. If the author seems to exaggerate here and there, it is but to drive home his point that the incompetent military leader is the greatest of mass murderers. Since the book is chronologically arranged, and provided with a full and well-chosen bibliography, it is comparatively a simple task to check upon any of the statements made therein. Even without special research, however, the moderately informed reader is compelled to agree with the basic though shameful facts gathered by Mr. Westrate.

On the character of the "fatal generals" depicted in this book, Mr. Westrate seems quite fully correct. But on his criticism of their military movements and actions he is occasionally to be challenged. Thus, his complete blaming of General Scott for our heavy losses at Churubusco and at Molino del Rey, fails to take into proper account the grave difficulties of operating in a little-known and extremely rough country, with poor, and sometimes false information. Similarly, the bald and unsupported statement regarding Pickett's charge at Gettysburg, that "Lee was too wise not to know it was hopeless", and "by the end of the second day Lee's last hope was gone, and he must have known it", is certainly not borne out by the best of up-to-date research, and must be based upon General Longstreet's peevish and quite contradictory accounts, made at various times long after the war.

In spite of these few faults, "Those Fatal Generals" is truly valuable, as well as of absorbing interest. It is badly needed to combat the conspiracy of silence, caused by moral cowardice and sloth, which has done so much to keep the American people in ignorance of our military history and therefore of our military needs. Through all our past runs the curse of politics, ignorance, and sloth. Pennies and annoyance saved. Billions and blood squandered!

The last of our military leaders to be considered by Mr. Westrate, is General Pershing. Here praise is very high, perhaps too high, though certainly far nearer the truth than Mr. Lloyd George's recent blast of wild criticism. At any rate, it seems well that the roll of generals considered by the book should close with one whom all must agree was and is a fearless and capable soldier and gentleman. Credit is also given (and due), to President Wilson for an act unprecedented in our history: that he selected a competent leader at the *start* of the war, and backed him to the end, in spite of adverse criticism.

In the last chapter of his book, Mr. Westrate summarizes his conclusions. This is well and succinctly done. It is to be hoped that "Those Fatal Generals" will contribute materially to the very slow yet discernible awakening of the American people to the military needs of their country. There is hope in the realization that at least one bitter lesson has been well learned from the disasters of our past. That is the criminal folly of short-term volunteers, and of troops of limited jurisdiction. May it not be too much to hope that America will awaken to the imperative need for adequate munitions and ordnance supply before swift, and possibly final disaster overtakes us! F. W. F. G.

THIS FLYING GAME. By Brig. Gen. H. H. Arnold and Maj. Ira Eaker. New York: Funk & Wagnalls Co. 1936.

"THIS volume is dedicated to the Junior Birdmen of America, the Jimmie Allen Flying Club, and other boys' aëronautic organizations, with the realization that they must take our places and man the vans of air commerce tomorrow. . . ." So, in part, reads the dedication of this book. Accordingly, one might expect it to be written in a manner simple enough to be understood by the juvenile readers to whom it is primarily addressed. And so it is. But despite that it makes interesting reading for any one of any age, and it explains some of the problems of airplane construction, operation, and navigation in such simple, understandable language as to make one suspect that perhaps other writers on these subjects have endeavored to make them difficult rather than easy.

The authors of this book need little introduction to the American public and less to military readers. General Arnold was one of our earliest military pilots, beginning his flying career in 1911. He has been flying steadily ever since. He has several world's records to his credit and has twice won the Mackay Trophy. Probably his most recent aëronautical achievement was his leadership of the flight to Alaska in the summer of 1935. When the GHQ Air Force was created, he became one of the three wing commanders and later was made Assistant Chief of Air Corps.

Major Eaker, like his coauthor, is a pilot of long experience and has occupied many positions of importance in Army Air Corps activities. He participated in the Pan American flight and was actively connected with the flight of the QUESTION MARK which set up the first worth-while world's record for sustained flight and refueling in the air.

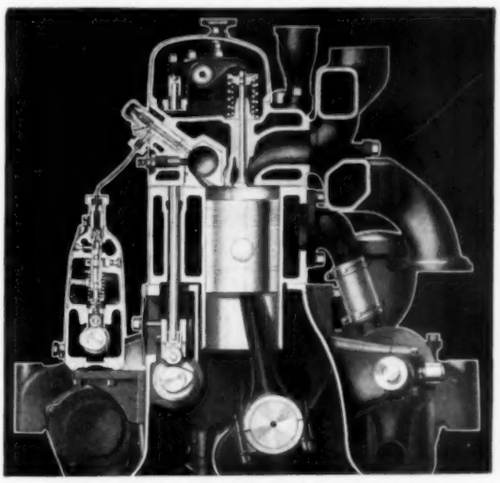
The first part of the book is devoted to a résumé of the history of the development of flying and includes brief descriptions of some of the outstanding flights. Particularly interesting are the charts which show graphically the advances made in altitude records, nonstop flights, and airplane speeds. In 1913, the record for nonstop flights was 634 miles; in 1933 it was 5657 miles. In 1913, the altitude record was slightly over 20,000 feet; in 1933 it was in excess of 45,000 feet. Airplane speeds made similar astounding advances, moving from 126 miles per hour in 1913 to more than 400 miles per hour in 1933. Such advances in a period of twenty years inspire awe when one considers what the next twenty years may bring forth.

Very briefly, the authors explain what makes an airplane fly and then describe quite fully what many of their juvenile readers are most interested in—how they can become aviators, what training is required, where it can be obtained, the type of examinations that must be passed, what the life of a flyer is like, and what the prospects are of a job. When one finishes reading this section, one comes to realize that the graduated flying cadets of the United States Army are airplane pilots indeed.

But pilots, airplanes and flying are not the only subjects treated in this very inclusive book. "'Flying', a sage once said, 'is a two-part mixture—a good airplane and a good pilot'. He was wrong. It is a three-part mixture, stirred well—an airplane, a pilot and a mechanic, and the last is not the least of the three." With these words, the authors pay a well-earned tribute to the men who, in season and out of season, day and night, keep the planes running. Here, at least, some credit is being given to "the man behind the man behind the gun." For it is indeed true that without mechanics nothing mechanical will run—very long.

It is well that these two experienced military pilots have taken the time and trouble to point out the fundamental differences between commercial and military planes and the different kinds of service for which they are built. Too many well-meaning but uninformed people think that there is little difference in these two kinds of planes.

After touching very briefly upon airships the authors venture



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to make prophecies as to the future of aviation. These prophecies may be carried out by many of the youthful readers to whom the book is dedicated, and if they profit by the lessons and experiences of the past twenty years what amazing developments may be just over the horizons! R. M.

On the Rim of the Abyss. By James T. Shotwell. New York: Macmillan Company. 1936. $3.00.

Among all students of international relations Doctor Shotwell has inspired admiration for his intense interest in the betterment of conditions in that field. As Professor of History at Columbia University and as Director of the Division of Economics and History of the Carnegie Endowment for International Peace, he has established a reputation for himself and his work of eminent fairness and sincerity.

This, his latest book, is a review of the world situation from the Paris Peace Conference to date. None of the major crises among nations during that period is omitted. All are discussed in their relation of the United States to the League of Nations.

This reviewer in kindly spirit agrees with nearly everything the author proposes except his dominant proposal; *i.e.*, membership of the United States in the League. Nor is the differing to be ascribed to prejudice, bias or militancy. Rather on the simplest basis that the League, having functioned not as an instrument of peace but solely as a forum of political expediency, its present status is an obstacle, rather than a help to international accord. It has not been willing to face squarely such issues as came before it and there seems to be no prospect—whether the United States is in or out—that it ever will. This is not to say that if a League could be a League without political expediency it would not be an advantage. The author himself concludes his study by saying, "There is no other way to secure permanent peace than by maintaining an international organ of coöperative pacification. The League is that one body. . . . . The final question is not what the League has or has not done, but what it will have to do in the future and how it can be put in a position to fulfill its mission." To us the record of nearly twenty years is so futile that we must answer "We would" to Doctor Shotwell's final question: "What citizen of the land that shares the heritage of Washington and Jefferson would deny it the proud privilege of being a member of that vanguard of the forces of history which already can catch glimpses of the ultimate goal and has the courage to move out from the shadowy and tragic past to its attainment?" O. E. D.

The War of the Guns; Western Front, 1917 & 1918. By Aubrey Wade. New York: Charles Scribner's Sons; London: B. T. Batsford Ltd. 1936. $3.00.

This is a unique book not because of the author or the text but rather by reason of what the publishers have done with it. Around a narrative story of personal experiences in war the publishers have seen fit to illustrate the book profusely with "horror" pictures which have very little if anything to do with ninety-five per cent of the text. In a special preface the publishers say: "The war described in Mr. Wade's plain words and illustrated in these unforgettable photographs was, to say the least of it, an ignoble thing; we should like to think that the volume that emerges may be used as an instrument, however humble, to prevent a recrudescence of these and worse horrors, towards which the nations today seem inevitably and despairingly to be drifting." The resultant book should make fine reading for those genteel souls who do not know the immemorial nature of battle and who believe that no principle of justice is worth giving one's life for.

The author was a member of the British Territorial Army. His organization, after two years of training camps and

maneuvers in England, sailed for France late in 1916. The period at home was obviously long; His Majesty the King, during an inspection "shared the general surprise of our being at home." Once arrived on the Continent, Mr. Wade's narrative, beginning with station at Herzelee, involved service as a field artilleryman at Ypres. Here the lesson was apparently "either to live or to be killed or struck by a flying piece. Till then somehow our nervous systems must be keyed up to stick it if we could". Thereafter there are descriptions of the individual services of the author in many of the important battles on the Western Front including Passchendaele. There are realistic accounts of life in the front line, the retreat at Cambrai with several interludes for rest. The author, having been wounded in battle, was convalescent in a camp at Buchy at the time of the Armistice.

There is a queer sort of an introduction to the book by an infantryman of those days, Edmund Blundon. We have no desire to be critical of the publishers in turning an otherwise well-written personal narrative into a piece of propaganda. There is nothing new in the revelation that the World War took frightful toll in human lives. In battle it is quite obvious that dead men's bodies are not the most pleasant sights. Until now the souls of those bodies have been regarded as heroes. To us they still are and always will be. The result in this case is that the real merit of the author's work is minimized by the sensational inclinations of the publishers. L. A. C.

MEMORIES OF PEACE AND WAR. By Maj. Gen. Beaumont B. Buck. San Antonio, Texas: The Naylor Company. 1935.

THE memoirs of men who have participated in historic events are the chief means by which these same events may be seen in their human perspective by those who follow the history-makers. Such a book is this interesting volume by General Buck.

Born in 1860 in Corinth, Miss., the son of a Confederate soldier, Beaumont B. Buck spent his boyhood in Tennessee, got the usual run of schooling of that day, learned the printers' trade, moved to Texas with his family when twelve years old, started to school again at eighteen, after six years as a job printer, and entered the U. S. Military Academy in 1880.

His first station as an Army officer was Fort McIntosh, Laredo, Texas. The pictures he sketches of life in a border post in the middle eighties bring forcibly to mind the changes that have occurred in the last half-century, not only in our mode of life but in Army methods as well.

Due to illness, the General's part in the Spanish-American War was small. His experiences in the Philippine Islands, however, were many and varied and form some of the most exciting parts of his narrative.

But, in my opinion, the best part of the book is that part telling of the battles of Cantigny and Soissons and the part he and his troops played in them. Vivid, thrilling and realistic, these chapters paint a splendid picture of the modern battlefield.

That one may realize that these descriptions of the World War are written by one who experienced them, let me summarize General Buck's World War service. He went overseas in command of the 28th Infantry of the 1st Division; arrived in France in June, 1917, was promoted to brigadier general and given command of the 2nd Infantry Brigade, including his old regiment and the 26th Infantry; took his brigade successfully through the Cantigny and Soissons operations, and on August 25, 1918, was made a major general and placed in command of the 3rd Division.

The last part of the book is devoted to public addresses given by the General, who enjoys a well-earned reputation as a public speaker. Not the least interesting of the General's narrative is his account of his contacts with more prominent personages—Theodore Roosevelt, Calvin Coolidge, Marshal Joffre, General Bullard, Premier Clemenceau, and Admiral Byrd, to cite but a few. This timely and interesting book is indeed worth reading. R. M.

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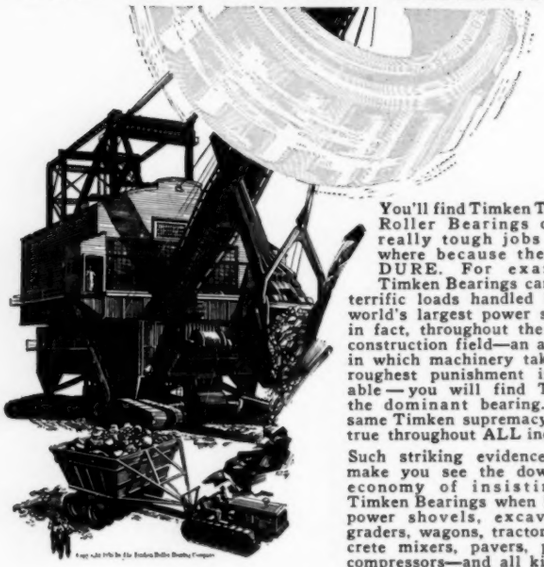

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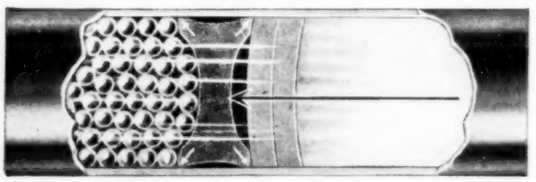

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